

BEFORE THE

FEDERAL ENERGY REGULATORY COMMISSION

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IN THE MATTER OF: _____ : Docket Number

REGIONAL TRANSMISSION ORGANIZATIONS (RTO): RM01-12-000

ELECTRICITY MARKET DESIGN AND STRUCTURE :

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Commission Meeting Room 2C

Federal Energy Regulatory

Commission

888 First Street, N.E.

Washington, D.C.

Thursday, February 7, 2002

The above-entitled matter came on for technical conference, pursuant to notice, at 9:35 a.m., Andrea Wolfman, Moderator, presiding.

BEFORE COMMISSIONERS:

CHAIRMAN PAT WOOD, III

COMMISSIONER LINDA KEY BREATHITT

COMMISSIONER NORA MEAD BROWNELL

COMMISSIONER WILLIAM L. MASSEY

APPEARANCES: (AS HERETOFORE NOTED.)

ADDITIONAL APPEARANCES:

PANEL 5 MARKET POWER MITIGATION

JOHN HILKE, United States Federal Trade
Commission

DAVID PATTON, President, Potomac Economics

JOE BOWRING, PJM Market Monitor

CRAIG ROACH, Boston Pacific Consulting

SCOTT HARVEY, LECG, Inc.

ALLEN MOSHER, American Public Power Association

JADE EATON, United States Department of Justice,
Antitrust Division

DON GARBER, Attorney, Sempra Energy

SONNY POPOWSKY, The Consumer Advocate,
Pennsylvania

ADDITIONAL APPEARANCES (CONTINUED):

PANEL 6 MINIMIZING IMPLEMENTATION COSTS

DAVID SUN, ESCA

YILANG CHEN, ABB

ONGUN ALSAC, Vice President and Director

Nexant, Inc.

GUILLERMO IRISARRI, Executive Vice President

Open Access Technology International, LLC

GORDAN VAN WELIE, President and CEO

ISO New England

ANDREW OTT, General Manager

Market Coordination, PJM Interconnection, LLC

DEJAN SOBAJIC, EPRI

ROBERTO PALIZA, Principal Consultant, Midwest ISO

H.B. (TRIP) DOGGETT, III, Consultant, ERCOT

P R O C E E D I N G S

(9:35 a.m.)

MS. WOLFMAN: Good morning. I would like to welcome everyone to our third day of the standard market design conference.

MR. FERNANDEZ: I was enjoying someone else being the one who had to tell people to go their seats. It's the third day. I think we're going to have a session this morning on market mitigation and one in the afternoon on minimizing costs of implementation of standard market design which primarily will deal with software issues. We're going to use the same basic format as we've used for the other two days, which is that we'll start out with brief opening statements. We'll try and work in a break and allow some time for questions from the audience at the end.

Andrea Wolfman is the moderator for this morning's panel on market mitigation.

MS. WOLFMAN: This panel has a rather broad range of topics to talk about. We are going to spend about half the time talking about the general principles that should guide market power mitigation. And we'll use, as our focus, a strawman discussion paper that has been released and shared with the panel that proposes some principles to be used in the design of market power mitigation measures.

We'll also focus on some more specific questions

we've asked the panel to talk about. These questions are what are the structural elements that should be built into the standard market design to mitigate significant market power. There are techniques such as demand response proxy caps, liability must-run provisions. We hope to identify these and others that are important to be in the design of the markets from the beginning.

We want to talk about how effective these are in mitigating market. Do the existing techniques that have been used need to be altered or augmented, and what are some of the best practices.

Then we want to ask the important question. Is it sufficient to mitigate market power through just the design of the market, or do we need additional mitigation tools. And if additional tools are necessary, what should they be. And importantly, what specific conditions or events should trigger these mitigation tools.

Then we hope to also talk about what standards should be used to determine if the mitigation measures are effective and at what intervals they should be reexamined. So we've got a lot to cover. We hope we'll have a good discussion, as with the other panels. During the conference, we hope to reserve time at the end for questions from the audience and we'll have a break at an appropriate time.

Following our style from the past, what we will do is I'll introduce the first panelists. If each panelist could introduce yourself and give us a brief presentation of your overall views, and then we'll go into more specific discussion after that. Let's begin stage left with John Hilke from the Federal Trade Commission.

MR. HILKE: Thank you. I knew I was either going to be first or last. So since I'm first I'll have to tell you that Allen Mosher stopped me in the hall and asked me for my main three points, and I said, sort of paraphrasing something from the real estate business, structure, structure, structure. Let me start by saying that my views today are my personal views and don't purport to be the views of the Federal Trade Commission or any individual commissioner. And that allows me to say lots of things I probably wouldn't otherwise say.

I think my role here today is sort of as the visiting advocate for structural remedies to existing horizontal market power problems. The antitrust paradigm, as you probably know, is if you get the structure right, then you can let the market go forward with out much intervention as long as you take care of anticompetitive mergers and anticompetitive practices.

The FTC Staff has filed a number of comments with FERC and with several of the states, all of which go back to

the theme that structural remedies to market power problems are generally better than behavioral remedies, in part because the structural remedies directly affect the incentives and also because behavioral remedies rely on detection and proof which are quite problematic in an industry, like electricity, where so much is done on a real time basis. My personal view is that historical conditions in the electric power industry are fairly unique. Probably every industry says that but in here in this industry, we've had a situation where for 70 years, there basically wasn't any antitrust review and therefore a lot of things happened structurally which probably wouldn't have happened if antitrust had been applied during that time period.

So we start with a position in this industry which is quite different, that is, that there very well may have been lots of mergers which create existing market power situations. So I think we come down to basically three policy questions.

First, how much existing horizontal market power is there in generation. Second, how can existing market power be separated from security rents, and third, what should be done, if anything.

So far, the responses to these questions in the various states and here at FERC have sort of ranged from let's do behavioral rules anyway to structural reforms sound

like a good idea to let's give up and just go with traditional regulation. Some of these responses may not be ideal from the perspective of consumers or consumption or competition.

Let me make three quick additional points in terms of introduction. The first is a plea really to recognize that while divestiture is probably the sort of premier structural remedy, lots of other things are also effectively structural remedies, including things like getting rid of transmission bottlenecks and trying to remove obstacles to rapid siting decisions.

The second is to urge people to continue and grow the recognition that wholesale and retail competition are closely related to each other and in particular, as FERC thinks about standard market design, I don't think it's inappropriate for it to mention things that ought to be part of standard market design which FERC can't directly control itself. That is, to recognize that there are things which the states have to do in order to make these markets work properly, and I don't think FERC should shy away from saying those things.

The third and last one is to emphasize that on-going attention to structural remedies can do a lot to take care of past or existing market power as well as head off new market power, all to the benefit of consumers and to

competition generally.

Thank you.

MR. PATTON: Good morning. My name is David Patton. By way of background, I serve as the independent market advisor for ISO New England and the New York ISO. And my firm has been retained as an independent market monitor for the Midwest ISO.

I found myself, as I read your paper, impressed with a number of insights that are in the strawpaper, and in trying to develop comments, I've pretty much found it impossible to figure out how to say anything in three minutes other than my name.

But what I'm going to do is make a couple of points and hope that our discussion leads to I think some of the more interesting insights that are relevant to the market power discussion. I hope we would all agree on this panel that the most fundamental provision for mitigating market power relates to maximizing the use of structural elements of the market to mitigate market power and so in that realm are minimizing barriers to entry for transmission and generation. I think one perhaps overlooked important element is creating the right incentives for those that are operating the system to not be overly conservative in how they operate the transmission system because to the extent that you can increase the utilization of the transmission

system that only in the very short term without investment may mitigate the market power that may exist in various locations.

As far as market design, I think there are some important elements. One thing I agree strongly with in the paper was the relationship between market design and potential market flaws and market power and the fact that market flaws can create market power. They can also make it extremely difficult to detect and mitigate market power.

I'll give you two quick examples of that. Pay as bid versus market clearing prices. I think we presume when we say that suppliers will bid their marginal costs that you're talking about a market clearing price mechanism. I think there's general consensus that that's preferred but even in market clearing price markets, like a locational marginal pricing system, there are often situations or rules that allow for dispatch of generation out of merit to resolve certain reliability criteria. If that's done extensively, you have to understand that the generators who are being called out of merit are now in a pay-as-bid sort of world. And the only way for them to achieve the market clearing price is to raise their bids, which makes it difficult then to distinguish between market power and pro-competitive behavior. So minimizing the pay-as-bid aspects, even in a market that's fundamentally market-clear price-

spaced, is important.

A second element that I would identify in the market design realm is having efficient reserves markets. When we talk about prices being set in periods of shortage, what happens in periods of shortage is that you get short of reserves before you're short of energy. And if you have a market design that doesn't optimally select your reserves versus your energy, you can get price spikes happening much sooner than they ought to be, which sends artificial price signals and may give increased incentives to withhold.

As far as discussing structural elements, structural mitigation versus mitigation tools, I think it's extremely difficult to separate those two. And the last quick example I'll give of that is with regard to economic withholding. Generally, you can mitigate economic withholding with some form of bidding restriction or flexibility limitation, so some of those might look like market design elements. Like if I told generators that they could submit one bid every six months, that would be pretty effective because if they wanted to raise their bid price to take advantage of short-term opportunity, they would incur tremendous costs in all the other hours. But then you have very similar mitigation measures that limit flexibility but they are triggered on the presence of certain conditions and I think that's far less onerous. It looks like a mitigation

tool rather than a design element, but they're really the same thing.

So in the context of our discussion, it may be a little bit difficult to differentiate the structural mitigation from mitigation tools. But I look forward to the discussion of these issues.

MR. BOWRING: Good morning, I'm Joe Bowring, market monitor for PJM. As David said, it's tough to talk about any of this stuff in three minutes. But I will try to address some of the issues raised in the paper and some of the issues raised in the question. And then, as Andrea said, we can get into it, once I'm done with the three minutes.

The first point here is what we are really about is, even though the name of the panel is market power mitigation panel, what we are really about obviously is competition. And what we all prefer is that what we're about is creating competitive markets. Speaking for myself, at least, I prefer not to have to do the job I do. But it is necessary and it will probably be necessary for the foreseeable future.

Not to get too detailed, but I think where we have to start is we have to start with a clear definition of market power. There are lots of definitions floating around but I think the simple best economic definition is where we

have to start. Then the question becomes what level of market power is acceptable. That's a regulatory decision, but the definition of market power is simply when the marginal cost of the marginal unit is equal to the market price, it's very simple, it's standard economics. There's not really any room for debate about that.

What the debate is about is whether or exactly at what levels of market power and actual practice are acceptable. Of course, defining marginal cost is never as simple as it appears. In addition to being short run, marginal costs includes aspects of opportunity costs for limited run hour units and things like that.

The goal of market design and any additional mitigation measures should to, first of all, incent competition. And as John pointed out, the point of wholesale market competition is not so much the stand alone. It's also market competition. But to facilitate retail competition it's important to remember the links between those to markets when we're thinking about how to ensure competition in the wholesale markets. It's an addition to eliminate the incentive to exercise market power and ultimately to remove the ability to profit from market power.

Just to quickly review what I regard as some of the key structural elements of a standard market design that

tends to inhibit the exercise of market power, the first coming from PJM is obvious but still I think critical. I had the good fortune to inherit what I regard as a quite good market design when I got to PJM. So the first is a transparent, bid-based, security constrained spot market with locational pricing. We can talk about it, although I won't right now, why each of those is important.

Another key feature is that the that the market rules have to permit easy imports and exports into, for example, the energy market. If the rules, for whatever reason, make it difficult to import, it has a significant impact on the extent to which competition can occur, particularly in times of high demand. The spot market also must be as flexible as possible. Market participants should have the financial choice to make any sorts of contractual arrangements they want, whether it be 100 percent reliance on the spot market, or 100 percent hedging, bilateral arrangements or buying on the spot market.

One feature of the PJM energy markets that's been in place from the very beginning as part of the initial filing for market rates was a thousand dollar price cap, a thousand dollar offer cap to be technically correct. That ultimately was an arbitrary decision. It clearly wasn't based on a value of lost load or any other calculation. It was seven or eight times the highest marginal cost. It was

higher than anyone could imagine the price ever getting and seemed reasonable for that very reason. In fact, it has stood the test of time and empirically we have seen in PJM over the years of having market-based rates that that offer cap has been consistent with permitting high prices, permitting price spikes, not permitting over-recovery and also been consistent with generators recovering fixed costs, and in fact in many cases recovering more than the required fixed costs. So it's worked. It's worked as an ultimate backstop for demand which can't defend itself in the absence of PSM and it now has an empirical base.

One other key element obviously of PJM's market power mitigation, something which is not directly done by the marketing monitoring unit, is the way in which we address local market power. Again, when the original utilities filed for market-based rates in PJM, they found that structural conditions were such that competition looked adequate in PJM as a whole, but we were very much aware of the changes in the transmission system congestion could result in local market power in an unpredictable manner and this was all designed in the rule which permits PJM to cap the offers of generators at marginal cost plus ten percent when that exists. And also, and it is not always well-recognized that those generators get paid the higher of the actual LMP or their marginal cost plus ten percent. In

addition, it's possible to negotiate ways around that.

In fact, as Craig will probably mention, one thing we look at is looking at, in effect, the option value of the ability to run that we are requiring generators to provide. There are additional, more sophisticated ways to look at, but nonetheless I think that's a central piece of PJM's market rules.

Without going through the others in detail right now, we'll get to that. I would just add that one of the things PJM has done to add markets incrementally and we've been careful to evaluate the likely competitive conditions in new markets as we have them. As we entered the regulation market, we analyzed that and it was clear structurally that there was a great deal of regulation capacity and that the conditions were likely to be competitive.

The next market we're introducing is a spinning market. The spinning market is actually fixed. What we found is that there are parts of the spinning market which don't appear to be competitive and the market design which we're actually going to file will reflect that. There will still be some cost-based elements in that. It makes sense to think about it before you introduce the market instead of simply assuming that competition will occur.

Finally, the reactive market is unlikely, in the

near future, to be capable of being competitive at all
simply because of the underlying physical facts about that.
Thank you, I look forward to this discussion.

COMMISSIONER BREATHITT: Alice, can I just ask Joe to repeat his definition of market power? I got down to when the marginal cost equals.

MR. BOWRING: First I said it was going to be very clear, then I probably mumbled it. Market power is the ability to raise price above the competitive level. The competitive level is defined to be the short-run marginal cost of the unit setting the price in the market.

MR. ROACH: Good morning, everyone. I'm Craig Roach with Boston Pacific Company. Boston Pacific is a consulting and investment services firm. Let me begin with commenting on the strawman paper. I thought it was a constructive presentation, a balanced presentation. There are several principles in that paper that I can agree with, principles such as mitigation should be prospective, not ex post. That we should worry about sustained market power, not temporary market power. That price responsive demand is key, and that if we get it we will be able to lessen our mitigation efforts. And that when we assess market power, we must take account of scarcity value, opportunity costs and risk.

I come to this topic of market monitoring and mitigation trying to be very much a realist. I understand the political reality that if we're going to retain consumer confidence for at least a little while, we're going to have

to have a very strong market monitor, and that's going to include specific mitigation measures. But I hope as we design those mitigation measures we keep in mind other realities. And the most important of those other realities is that if we do things in mitigation that slow or stop investment in supply or demand-side response or transmission and gas infrastructure, then we're going to harm the very consumers that we're trying to protect.

But with all those realities in mind, let me try to make a few constructive suggestions on the three types of mitigation that were mentioned in the strawman paper, then one broader point on assessing market power.

The first of the three was a locational offer cap. This is an attempt to protect against load pockets. I think it would be best and I think Joe just mentioned this, to view that right as a call option. That means that the RTO would have the right to call on that unit at a pre-specified price. It would be great if those prices could be determined competitively, not day to day but through some sort of competitive negotiation, RFP, something like that. And if there are caps placed on that price, it would be good for those caps to reflect the ways to get out of that load pocket. That is, to reflect the cost of building transmission or new generation that would eliminate the load pocket concern.

Finally, one caution. It's going to be real important that we stay disciplined and only apply this to load pockets. Let's not apply this to broad geographic areas.

The second of the three is a maximum offer cap. I like the idea of characterizing it as a proxy for demand response. I think we can work with the \$1,000 bid cap that has already been in place in the East.

But a couple of other things. One is since it's a proxy for demand response, it should work its way out as we get demand response. In other words, that cap should go away, if we reach a certain threshold of demand response, a number of customers, a percent of peak load.

I think also we should be wary after a couple of years with this price cap if that price cap itself is stopping demand response, and we should be prepared to increase the cap. Finally, I would only use caps in markets that have capacity requirements that create capacity value.

The third type of mitigation is bidding flexibility. Again, this one I would do only in markets with a capacity requirement. Here I'd like to think, and I think it would be best if we thought in terms of a price screen, not a price cap. Every time I went out to talk about an exact screen, I found that this is really difficult terrain. Here's what I would suggest. This is something we

really don't want to do in this morning's session or on the back of an envelope.

I think what we want to do is have the Staff request technical papers, papers that would make an explicit proposal for a price screen. Secondly, state what that proposal is meant to achieve, and that's really enlightening. Third, illustrate the implementation of that screen hopefully with the real world data on one of the established markets. Then we could have another technical conference, nonadversarial. Let's air that out.

This is really, really difficult. It's not about being smart. It's not about being special. It's just tough.

Now the screen is important because I would like to see that screen become tied to any allegations of market power abuse. What I mean by that is, first of all, I'd like to see a safe harbor established. If that screen is not broken through, everybody's in a safe harbor. There will be no allegations of market power abuse. I think that's a way to make this all prospective in its enforcement.

Secondly, in terms of the process, it would be great if we could take any allegation, have it done in 60 days. I think that process should have due process. That means if someone is charged, they have a right to respond. And in order to respond, they have access to everything that

the market monitor used to make the allegation in the first place.

I think the methods of looking at market power should include the right definition. And as the strawman paper suggests, again, must take account of scarcity value opportunity costs and risk. And if there's anything structural, if we need a structural tool to assess market power, again, turning to the strawman paper concern with confusing scarcity with market power, I still have concerns with a test based on SMA. If the Commission would like to tighten the test, move from hub and spoke, I'd really prefer that you borrow the concept of economic capacity from the merger test that you use, the delivered price test that you use.

And finally, one final comment, this is just a hope of mine that with all these tools in the tool box of a market monitor, I would really hope that it would be unnecessary to have the refund condition first introduced on November 20th. I think these tools will be enough. And I have some real concern, getting back to my second reality, that a refund condition that's not defined as well as these tools are would stop or slow the investment that consumers need to get reliable, competitively priced supply. Thank you very much. I'd be happy to discuss any of this later.

CHAIRMAN WOOD: Just before you hop on to Scott.

on number 2 and number 3, use them only in markets with the capacity requirements that you said create something?

MR. ROACH: Create capacity value.

CHAIRMAN WOOD: In other words, that the tradeoff is like in ICAP, you've got basically a prepayment on some of your fixed costs. So you're linking the \$1,000 price cap not only to the demand side but also to the fact that there is an opportunity to recover some of the fixed costs through the ICAP requirement? And you link the price screen to that as well. Tell me more why that price screen is linked.

MR. ROACH: I'll tell you what my concern is, is that, you know, what we're doing with these screens and what we're doing with the cap is we're to some extent artificially blocking volatility. And my concern immediately is that if you have an energy-only market, prices sometimes have to go very high in order to encourage investment, even if you simulate this.

We've done this internationally. We've gone in with a model that can either have an energy-only market and let the prices go where they want to go, and then demand that that model give us reliability, or we put in a capacity price. And almost every time we get better entry, lower prices, less volatility when we have that capacity value. So I'm worried if we artificially limit volatility with a cap or with a price screen, we're just not going to get

enough investment.

CHAIRMAN WOOD: Okay. Thank you.

MR. HARVEY: I'm Scott Harvey with LECG. I'm also a consultant. Like John, I have a disclaimer that the things I'm going to say are my fault, and they're not the fault of anybody that I work for. Particularly, you can't blame the New York ISO or Midwest ISO for anything I'm going to say.

Also, like John, I am also an ex-antitrust enforcer. I spent ten years at the Federal Trade Commission, so I have that perspective which will govern a couple of my comments.

I liked almost everything that I read in the straw proposal, and there were two things that I thought that maybe I could add some additional comments on that would be useful. The first, there was a comment in the straw proposal to market rules such as port auction designs can create or enhance market power by artificially limiting entry, preventing demand response, providing artificial incentives to withhold. And I agree totally with that.

I'd go further and say it's also important to the market design to not place any artificial restrictions on the generators that can respond to price signals. That you don't have zonal pricing where only the generators in the zone can respond, or only the generators that have a

significant impact. All of these things are important so that all the competitors can respond to high prices.

But at the same time we need to recognize that the most efficient design in the world, if I own a preponderance of the generation behind a constraint, you may make the market incredibly efficient, but I'll still have market power and I'll still use it. So in the end, efficient market design is a starting point, but as several people said, it doesn't solve the problem.

And I agree with the comments that the structural remedies are best. That's what we ought to try for. The discussion that you've already heard illustrates the complexities of when you try to go to behavioral solutions. You heard all the things that people want us to worry about. It's very difficult. I'm not sure you can have a standard set of -- this set of market power mitigation will work all the time. Going back to my antitrust perspective, I think if it's an antitrust problem you're worried about in the sense of market power, and that's why prices are high, there ought to be specific entities that have market power and you ought to be able to tailor a remedy that fits it. And if it's just the high prices, then maybe you have something that applies all the time.

Now the second theme related to market power is there is a comment in here but not in the straw proposal

that noted that antitrust statutes provide for different standards of liability enforcement mandates and tools in the Commission statutes. And I think that cuts two ways. On the one hand there's conduct that's not illegal under the antitrust laws, particularly things that come out of the existing structure electric industry that we have to have mitigation by the Commission before the market starts or have a mechanism for mitigating market power that arises from the structure.

At the same time, I think the Commission needs to make it clear to market power monitors and ISOs that they are not antitrust enforcers and that if you see entities changing their bids simultaneously or nearly simultaneously, and it's in a short period of time, it is not up to the market monitor to figure out if there has been correspondence, but Charles James lawyers who can subpoena telephone records and investigate that.

That if you have entities that haven't filed a joint venture that appear to be coordinating their bidding, that isn't up to the market monitor or the ISO to decide if that's illegal. Again, that's up for Charles James lawyers to resolve. And I think it ought to be clear that there are things that the ISOs and the market monitors ought to be looking at. But then there also ought to be just, you know, let the market deal with the antitrust division. And I

think that is something that needs to be made clear. That's all I have.

MR. MOSHER: Good morning. I'm Allen Mosher. I'm Director of Policy Analysis for the American Public Power Association. I want to thank you all for inviting me to speak here.

I represent, rather APPA represents the nation's 2,000 or so state, municipal and local electric utilities. We purchase about 70 percent of our electric energy requirements, so we really do depend upon the electric power market to work competitively. We need to buy it from the marketplace. I've found from experience that when markets don't work well, we are forced by these operations to self-generate in ways that may or may not make sense. If we can get the markets working better, then we'll have a better market overall.

I think it's also important to realize that if we want to have a balanced portfolio of resources that we can buy from the marketplace and that restructuring is starting to interfere with our ability to do so. It's become increasingly hard for us to meet our needs to do our power supply procurement because of the complexity of the market and also the uncertainty, the fact that we're changing all of the rules is definitely interfering with the capacity and energy acquisition plans for our members. So we do need to

resolve some of these issues.

But we shouldn't be moving too quickly to resolve it until we've dealt with all the problems. And as John mentioned earlier, I asked him before we came in, well, what are your three main points? And he said structure, structure, structure. I agree. We have a vertically integrated industry that we're starting to restructure by separating out the transmission portion. But we also have a horizontally concentrated industry with many load pockets, with many states that one or two utilities owns 70 percent or more of the generation within that state.

I find it very hard to understand how we're going to make many of the market rules we're proposing work in any immediate future. Because, again, those markets just are structurally not competitive.

A few simple points here, I mean beyond structure of rules. The market mitigation measures that are in the paper, they make a lot of sense. It sounds very good. But this is behavioral. Unless we have the right structure in place, I don't understand how we're going to make it work.

We certainly through a standard market design can reduce barriers to entry, can encourage new transmission, new generation. But again, unless we have the right structure coming up front, then we're going to have repeated regulatory and market failures across the country. And my

greatest fear is that FERC will impose a standard market design before we have the answers worked out, and you'll be confronted with a series of California-like problems. And basically no one is going to be able to keep up. And it will be so overwhelming that we will set restructuring back at great cost to all of us potentially by years.

Let me go through a list of some of the things that we need to get right that go beyond just the standard market design and the market mitigation tools here.

Application of supply margin assessment or probably the delivered price test would be a better approach. That's critically important. Underlying that, you've got to have good market model. You've got to be able to understand within this building how the markets are actually performing. If you don't understand, you can't expect the marketplace as a whole to understand.

You need to work with the best of the market monitors within the existing RTOs and ISOs, learn the tools they have, and then even have a better sense of what's going on.

Secondly, market-based rate conditions. I'm afraid I'll have to disagree with Craig. I think that's a very important backstop. And I think that we need to have a backstop on all market-based rate sales so the Commission has the ability to, based on the information it has, to

quickly intervene. One of my great concerns is the market monitoring units of the ISOs are really focused on their particular market. They're not focused on the market as a whole. So who's dealing with the seams problems here? We need market monitors with a scope that matches up to the marketplace as a whole, and that's regional market monitoring, not necessarily RTO market monitoring.

Next point, getting your Office of Market Oversight and Enforcement up and running. Until that office is in place, you don't have the tools you need to understand even whether your policies are working. And the emphasis on making sure that that office can do the job, that really understands what's going on so that you get the information to know whether the market is performing rather than just trust us -- Gee, it's looking okay -- that's critically important, because you need to have early indicators of when things are going to be going wrong.

Next, transparency of information. Customers need information. Not just market monitors. Not just FERC Staff. If we don't get the information out there on the ground to understand what's going on, then we have an asymmetrical information situation where entities with large portfolios of generation have a pretty good idea of how the market works, and they can, by trial and error, figure out the best strategy to either gain the maximum amount of

scarcity rents, which theoretically is okay, or to exercise market power, which is not okay. Smaller entities in particular are at a great disadvantage, because we don't have all the data points from around the market.

Next, more transmission. Enough said. We've got to have more transmission in the marketplace. That will cure a multitude of sins, or at least push down the level at which the market monitor has to intervene.

Next, generation adequacy. I was very encouraged by Chairman Wood's remarks recently about the importance of keeping track of the adequacy of the overall generation supply within a region. The thing that comes with that, of course, is the responsibility of customers, and in my case load-serving entities, to contract forward to get the generation that they need and to have that on line. And in that respect, I also will agree with Craig that if you move things away from the spot market, you're probably doing the marketplace as a whole a favor by focusing on long-term contracting.

Next, structurally competitive markets require governments of all types to use the regulatory tools that they've got. And I'll say the "d" word, divestiture. That's an important consideration. But that authority really lies with the states. And I frankly don't see a lot of divestiture, further divestiture coming. So we need to

figure out other mechanisms to accomplish the same kind of reduction of market concentration. FERC needs to actively use its market -- I mean it's merger authority, and that includes generation-only mergers. You need to be watching for it, because I anticipate the industry may well concentrate heavily within the IPP sector in the next few years. If that happens, then the promise of restructuring will be lost.

I had some other materials, but I think I've run long, so let me stop there. Thank you.

MS. EATON: Good morning. I have to give the standard disclaimer. First of all, thank you very much for inviting me to participate in this really important panel. But my remarks here today are my own and are not necessarily the position of the United States Department of Justice.

But the United States Department of Justice, like the Federal Trade Commission, has over the past 25 years had a significant interest in the evolution of competition in the wholesale electric markets, and we seem to be right now at a really critical point. There's been a loss of confidence in markets. Political winds are blowing in perhaps a difficult direction for us all. And so it's quite important what policy decisions are made by the Commission. Because of all the price signals out there, perhaps the FERC's price signal is the one that will be heard the most.

I'm going to just, in the few minutes that I have, talk about first a little bit about what we do in all of this, meaning the DOJ and the enforcement authorities. The second, my one -- I had to pick one favorite thing from the strawman that I'll talk about a little bit, although I like much of what's in the strawman proposal.

And then because I'm kind of an outsider to the whole regulatory process, I think I can contribute somewhat by taking us back to some first principles that maybe we can touch on in our discussion during the morning.

First of all, what the enforcement agencies can do best is to help stop further concentration in markets through merger review. And secondly, to stop collusive activity among generators or other market participants in a single level of the market. And of course there are situations in which a vertically integrated company can use market power that it already has in one market to destroy competition in a second market. And so even though that's single firm conduct, we also have taken Section 2 cases. The Sherman Act will bar monopolization in those cases.

But what we don't do very often is talk about just the price in a market. And we can't make market structures that we see in front of us better just because we don't like the way they are. And so I want to point out again, if there's going to be significant divestitures in

order to reshape the markets as we've inherited them, that's not likely to happen under the antitrust laws.

So to step on to -- but we also are advocates for competition, and so I can talk a little bit about the regulatory proposals here. And the first thing I want to say about the strawman, my favorite thing is that on a number of occasions here, market power is discussed in terms of significant and sustained market power. And that little catch phrase did my heart good, because I haven't seen it in some of the other things that have been coming out of the Commission recently.

And it's important that we don't spend a tremendous amount of regulatory effort looking at passive price rises and hunting for market power in those short-term price rises. So I wanted to comment on that point because I really did feel better for seeing it.

Now I'm going to talk about some really overarching principles just for a minute. I think it is quite important for the Commission and for all of us to look at what our assumptions are about the role of regulation here. What are we doing at a very basic level? Is the situation -- are the market mitigation rules that we are trying to craft here based on an assumption that the regulatory scheme is really going to rarely be invoked because competition is robust in most situations, is a

backstop, are we assuming actually that regulation is going to be invoked even when market forces are acting correctly but when prices reach some level that we consider to be politically unacceptable, sort of maybe the just part of just and reasonable? Or are we assuming that competition is really not very effective? It's a nice adjunct to our usual regulatory toolbox and that we have to really set up a set of regulations that are going to be invoked fairly frequently.

The importance of understanding which of these sets of assumptions we are starting from is in determining the cost of error. Because if we think that markets are primarily competitive, then the cost of re-regulation is extremely high. We will lose all of the efficiencies that we have been trying to get from these markets over the past 20 years.

On the other hand, if we think that the cost of -- that we are going to need to regulate in many cases because there are significant and persistent market failures, then we have to still think about what the cost of the regulatory scheme is. Regulation is not costless. It costs money to run market monitoring. It costs money to keep a war room here where we can look at prices. If we're going to do that, it's important to note the cost of regulation and how we can do this most effectively.

But I want to say that the answers to the questions here about market monitoring are perhaps the most significant that we're going to run across. Because if we create good market structure and we then reimpose unnecessary regulation within the well-structured markets, we are going to stop efficient investment.

However, if we have no regulatory backstops in markets, we are going to lose consumer confidence, and instead of de facto re-regulation, we're going to have de jure re-regulation and it's going to be a long road back from there. Thank you.

MR. GARBER: Good morning, Commissioners. Don Garber, an attorney with Sempra Energy. Thank you for inviting me to participate today. I hail from San Diego. For the past 18 months I've been enduring the California energy crisis. I've studied many documents that purport to define and describe and quantify the exercise of market power. I should be getting smarter by now, but I fear that I'm just getting more confused.

I have learned one thing, however. The experts seem to differ on what constitutes an exercise of market power in the short-run physical electricity markets. Examination of the recent California experience by some analysts has led them to conclude based on certain simplifying assumptions that generators intentionally

withheld, economically and physically, substantial amounts of power in order to raise prices.

But other analysts contend that these assumptions are too simple, and they argue that scarcity and the often perverse incentives associated with the California market design might explain much of the behavior of rational profit maximizing generators. In short, they seem to argue that market power has not been proven to have been exercised. And they argue that more data is needed and better methodological approach would be required to actually determine whether or not market power has been exercised.

Now I think everyone agrees that some level of scarcity has prevailed. And most people seem to recognize now that the California market design was seriously flawed. But the question for me is, would a better market design or even the best market design have made a measurable difference under these circumstances? And I believe the answer must be yes. I think that because I think behavior follows incentives, and I think that the California market design systematically incented suppliers to undermine the grid operator and the market-based protocols that the grid operator was trying to use to preserve reliability.

Thus in my judgment, the first line of defense against unexplainable prices which may or may not have been caused by an exercise of market power or some other variant

of market manipulation, gaming or inefficiency, is an RTO using a well designed market coordination protocols much like those that are encompassed within the standard market design and that you're contemplating for an upcoming NOPR.

Secondary tools like circuit breaker caps maybe at \$1,000 a megawatt hour, and offer caps or contracts for differences to mitigate locational market power I think will have to be part of the design certainly until demand elasticity is greatly increased. But there will never be a substitute for an efficient, centralized coordination of the short-run physical markets.

I think the peculiar physics associated with electricity requires the short-run coordination and I don't expect that to change anytime soon. I say this because I believe that a good market design will actually incent market participants to maximize their profits by expressing their true economic preferences to the grid operator, and that they will then follow the operator's instructions that are based on those preferences.

A bad design like we have in California actually forces suppliers to speculate about the market clearing prices to avoid price discrimination. So they don't tell the grid operator what they really want to do and what their economic preferences are.

A good design creates operational transparency to

minimize mistrust and brinksmanship. In California, we've had low grade guerrilla warfare between suppliers and the grid operator.

A good design aligns prices paid to the value of power received so that the grid operator will not panic easily and resort to out-of-market transactions. In California the grid operator knew that the prices and the markets had little to do with the underlying physics and reality that it had to deal with. So when supply started to tighten, it quickly had to abandon the market-based processes in favor of command-and-control intervention.

And a good market design will enable market monitors and regulators such as yourself to understand the price formation process. Why prices are high, for instance. So that you can focus quickly on real problems as they manifest themselves, and so that you can defend the results from the market if you believe the market is functioning properly, and so that you can make the legal findings that you are called upon to make that prices are just and reasonable.

Thank you.

MR. POPOWSKY: Good morning. I'm Sonny Popowsky. I'm the consumer advocate of Pennsylvania, and I want to thank you for inviting me to participate in this morning's session. I perhaps do have a somewhat different perspective

than a lot of the panelists here today or a lot of the people you've heard from in the last couple of days.

My goal is not necessarily to achieve the perfectly competitive market that requires the least market intervention from either you or from the market monitors at a place like PJM. My goal is to try to achieve the best elements or combine the best elements of competition and regulation that's most likely to produce universally available reliable service at just and reasonable prices.

Now having said that, I believe that one of the most important means to achieve my goal is by developing a competitive wholesale market that is as free as possible from the exercise of market power. As a practical matter, though, I think that it will be difficult to eliminate all vestiges of market power in a wholesale market where at least some buyers have an obligation to serve, and where as a practical matter, at least some retail customers will not be able to just say no to extraordinarily high prices. Or as Joe Bowring just put it, where demand can't defend itself.

So, for example, I would be reluctant to eliminate the kind of overall price caps and must-run unit cost-based caps that we have in PJM, unless I could somehow be convinced that there are other equally reliable assurances of protection to prevent excessive prices for

retail customers.

I would also say that even in the best market design that we can come up with, I think there will always be a need for careful market monitoring, and at least the possibility of future mitigation measures to address the exercises of market power that we haven't yet thought of. If we learn nothing else from the Enron debacle, it seems to me that we ought to at least learn humility. That is, we really can't think of everything in advance.

Now with all those caveats, I basically agree with nearly all the principles that are set forth in the strawman proposal that we've been asked to address. Clearly, participating in a truly independent ISO with bid-based transparent markets is a necessary but not sufficient start to the elimination of market power and the creation of competitive markets. I also agree that developing demand-side response wherever possible will have a major beneficial impact on the creation of markets.

I also agree there's no question that structural solutions and rules that are set forth clearly in advance are vastly superior to after-the-fact price mitigation. I guess I also would like to see Joe Bowring and the PJM MMU be sort of like the Maytag repairman in the old TV commercials who, you know, is monitoring the market, but sure enough, he finds that the design is working as

anticipated 8,760 hours a year and 8,784 hours on leap years. But again, that doesn't mean that I would eliminate the market monitoring function.

Now I do have some slight disagreements with a few of the elements in the strawman proposal. I, for example, when you say that market power must be significant and sustained in order to have intervention, I would say it should be significant or sustained. I think you can, you know, slash my throat quickly or I could die a death of a thousand cuts, but in either case I think you need to have market power mitigation that can deal with both of those problems.

I'm also concerned with the suggestion that in the case of must-run units that prices would somehow be based on scarcity price signals rather than the kind of cost-based, higher of cost or LMP price that's used in PJM. And I'm also concerned about setting the price caps at the value of lost load.

But generally, as I said, I think the strawman proposal is an excellent proposal, and I look forward to continuing to discuss that and other issues as we go forward this morning.

Thank you.

MS. WOLFMAN: Thank you. Why don't we begin with a discussion at what seems to be the beginning, is the

definition of market power. And let me ask the panelists if you agree on the definition of market power that's in the strawman proposal and Joe Bowring used, or is the disagreement really on not the definition of what constitutes market power, but when should the government intervene in its exercise.

We can start at one end and work our way down if we want.

MR. HILKE: I like this being able to go first all the time. Sure. I think there's general agreement on the definition of market power in the sense that it's raising price above the competitive level. And also to the point that if you look at short-term transactions versus long-term transactions that the competitive level might be different in that sense in that variable costs, basically the longer you go out, the more costs become variable. And so you come something close to average cost pricing if you go out far enough.

So I think with those caveats in mind that there's probably going to be general agreement.

In the sort of out-of-the-price category, there are also concerns about levels of innovation and service. You can in fact keep the prices the same and make the service worse and worse and effectively raise price. Generally in antitrust, we think about price as well as

innovation and service levels. But other than that --

MR. PATTON: I would generally agree with the definition. I think on the significant and sustained issue, it's important to recognize that the level of volatility in this industry is far greater than in most industries, and it's due in part to the nature of the commodity.

And I would suggest that part of the reason you care about the sustained aspect is because sustaining market power makes it more significant. And so perhaps thinking about the significance is really the key issue. If I were to tell you that half a billion dollars in market power rents were extracted from the New York market, it's not entirely clear to me why you would care whether those were extracted in the course of a week or in the course of six months. And I think in fact the nature of market power in these industries lends itself to the largest risks being the relatively short-term but extreme rises in prices. And that goes to how can you effectively mitigate. I think that has led us in some of these markets to mitigation that is not very onerous, that seeks to look for very significant events before mitigation kicks in.

But the other element, though, that I think is somewhat misunderstood is the scarcity issue. And that is, do generators have to raise their bids in order to get to a scarcity price, a price that economists would argue is

efficient? And I think the answer to that is no, as long as you -- and I think you acknowledge this in your paper -- as long as you incorporate all factors that are relevant in marginal costs and don't limit marginal costs to variable costs, because if you incorporate unit-specific risks and opportunity costs, you do have resources in every market that will be at extremely high levels, \$1,000, for example. So that by setting prices at the marginal costs of those generators, you do get the scarcity pricing that you're looking for.

In the long run I think there are situations underneath that level where demand would set the price, and that actually is a more accurate price signal.

MR. KELLY: David, a quick follow up. You said that the main risk is from prices that are very high. That certainly gets the most publicity and attention. But as Alan Mosher was saying earlier, there is concentration locally in the industry.

If you have just a few firms that are selling power which in a competitive market might be at \$30 a megawatt hour but are selling it at \$33, a ten percent price increase, wouldn't make any headlines necessarily. But do it every hour of the year, wouldn't that be perhaps as great a risk but one that wouldn't get as much attention?

MR. PATTON: Well, the reality is that it's

really hard to do that. The reality is that the supply curve under most load levels is extremely flat. And so trying to raise prices significantly would involve a large amount of withholding, and if that's going to be accomplished by multiple competitors, it implies a level of cooperation between the competitors that's not easy.

And the reason it's not easy is even with three or four competitors under most load levels, you have a lot of excess capacity, and that excess capacity, the suppliers in those periods, there's a level of trust in what your competitor is doing so that you don't bear the brunt or bear the majority of the costs in trying to accomplish what you're suggesting.

What we found in our monitoring and analysis of the Northeast markets is that the prices under most load levels are extremely competitive. Where you can get sustained market power over many more hours is when you have transmission constraints that are binding frequently that isolate relatively small areas. And those clearly need to be addressed in a more aggressive fashion than the market as a whole.

MR. O'NEILL: Could I just ask as people address the significant and sustained or as Sonny said, significant or sustained, to attempt to quantify what that means?

Because if you're in a position like the Commission, you could live with that and maybe have never done anything in California or maybe have intervened very early in California. And the question is, in your mind, what does significant and sustained mean in terms of when the Commission should intervene and where?

MR. PATTON: A quick comment. In a lot of analyses we look at a five percent price increase that's over the course of a year, and that could be a starting point that might be too low. One difficulty of trying to address the low-level market power that occurs over many hours is there's a significant amount of uncertainty in the measurement of marginal costs so that when you try to identify market power in a typical hour, prices are \$50 versus \$53, there's a tremendous amount of uncertainty in trying to call that market power. So I think in application it's difficult to try to --

MR. O'NEILL: So I think you're sort of agreeing with what Jade said. You have to watch the cost of making errors in your analysis. There's a tradeoff, and we know we can't get it exactly right. So the question is you have to make an error assessment in intervening in these markets.

MS. WOLFMAN: Let me say as we go. We don't have to go down the row, and to get a livelier discussion, why don't we say if you want to respond and jump in, raise your

card and you can react to the point.

(Laughter.)

MR. BOWRING: I would like to go down the row.

MS. WOLFMAN: Okay. We will for the cards raised.

MR. BOWRING: In any event, I think as I made clear at the beginning -- all the cards are up now. Okay.

(Laughter.)

MR. BOWRING: So as I made clear at the beginning, I think the basic definition of market power is pretty clear. The one place where I would prefer that the strawman be clarified is the difference between short-run and long-run. I think the definition really should be based on short-run marginal costs. That's the economic definition.

Clearly, if markets work and you reach a sustainable equilibrium that has to be adequate to cover the fixed costs of the generating units. And in fact, empirically, we've seen that to happen in PJM. What that does mean, of course, is that then the issue becomes, as you pointed out, what is an acceptable exercise of market power. Because clearly, some small amount will be exercised frequently.

In PJM we've used just historically a rule of thumb of a mark-up of ten percent over marginal cost. But

as David says correctly -- and at PJM, we've been collecting marginal cost data for a long time subject to a thick book of guidelines about exactly how it's to be calculated -- nonetheless, there is uncertainty and noise in those numbers, and one has to be careful about imagining that there's market power when there's not.

I would also just maybe to liven things up a little bit to disagree with David a little bit about where and when market power can be exercised and when it's significant. I mean, certainly, price spikes can be an indication of market power, and a lot of money can change hands very quickly during a price spike which doesn't last very long.

So as far as that goes, the issue is not so much sustainable or sustained as sustainable or repeatable, as if you can always do this whenever demand reaches a certain level, then that is a cause for concern regardless of whether it's sustained for a few hours at a time but multiple hours every year.

But the other point I wanted to make was that we in fact have seen what we regard as significant mark-ups by mid-merit units, that is, units in the middle part of the supply curve, the flat part of the supply curve, as you get to particular load levels. And if you think of the supply curve as sort of having three components: Base, mid-merit

and peaking, and there's a significant difference in cost between mid-merit and peaking units, you clearly can have the exercise of market power when you start to get to that first elbow in the supply curve. Thanks.

MS. WOLFMAN: Craig Roach?

MR. ROACH: I don't think -- I mean, we all use the same textbook so we can go look up the definition, and I have a handout, a five-page handout and there's a definition of market power. My concern is that we don't do it in shorthand, that we use the full definition. You know, when a supplier exercises market power when it increases the market price for a sustained period of time above the level that would prevail in a competitive market and by doing so earns a profit.

I want to use the complete definition because --

MR. O'NEILL: Craig, can I interrupt? I mean, it doesn't seem that you, if I heard that John right, it doesn't seem that you and John are reading from the same textbook, because he didn't say sustained and prolonged or whatever the adjectives --

MR. ROACH: Profitable.

MR. O'NEILL: And profitable. I think he just said raising it above competitive market price. Are you reading from the same textbook?

MR. HILKE: Yes.

(Laughter.)

MR. HILKE: There clearly is a measurement issue here. If you look at the sort of scholarly industrial organization literature when people are really trying to figure out whether companies have, you know, exercised market power, they do a profit analysis. And they look at funds employed and what they earned on those funds and whether those were above essentially some benchmark, usually an interest rate calculation.

In the most scholarly approach, you would do a very complex analysis and look at the profitability of the companies over a period of time and if it's way above what is necessary to retain capital, then they've been exercising market power. And this is the type of analysis that was done, for instance, in the cereals case in the eighties. It's pretty complicated and takes a long time, and you probably can't wait for those types of numbers to become available.

MR. O'NEILL: Let me be more specific in recent experience. If it wasn't profitable, you wouldn't go after it, meaning that now we understood that a lot of what Enron did was not profitable.

(Laughter.)

MR. O'NEILL: That this is not an issue that we should concern ourselves with?

MR. HILKE: Well, there is this sentence here at the end of the definition which says something about we don't have to worry about it if it's not rational.

(Laughter.)

MR. HILKE: Well, that's certainly true in most cases. I mean, because of all the economic models assume economic rationality. If you step outside of that framework, sure, there are lots of crazy things which go on. They probably aren't very systematic because they sort of self-correct themselves.

But it's true that, for instance, we go after murderers even though they may not have an accurate economic calculation of the benefits of their activities because it's objectionable on other grounds.

MR. ROACH: Let me put the Enron comment aside. But let me say why you include these things. You include profitability for a policy and a practical reason. The policy reason, and I think John's hinting at this, is people don't exercise market power for kicks. And if you observe somebody doing it for kicks, something's wrong. So that's why you want to prove profitability.

Secondly, the practical element is, it's hard to prove market power. Sometimes to my disappointment, you go into a case. You've got a big company, lots of generation, and you must show that it's profitable. That as they raise

their price, that it remains profitable, even though they're losing business. And that's why you put profitability in.

Why do you use sustainability?

MR. O'NEILL: Could I just -- when you think about how FERC would have to implement that rule, we would have to then subpoena the records of the company to understand whether or not what they did was profitable?

MR. ROACH: No.

MR. O'NEILL: Well, how would we determine that they profitably exercise market power? What would our investigative standard be?

MR. ROACH: Even on an analytic basis, are they earning more on a margin, even if you estimate the margin -- you don't have to look at their books. If you estimate on the margin that as they sell fewer units at a higher price, are they still making the same margin that they were making -- in total -- that they were making when they sold everything at a lower price? You can use the model, any model that attempts to do that. So you don't have to go after the books. And the reason you look at sustainability and significance I think as Jade says, again, policy reason, but also a practical reason. The policy reason is, you guys are busy. You want to focus on stuff that really matters.

The practical reason is, that if it's not sustainable, if it's unique, if it happens rarely, I'm

really doubtful that it's market power. I'm thinking that it's something else. And it's always hard. And again, sometimes to my disappointment, it's always hard to prove market power. It's hard to sort things out, I think as David was saying, it's hard to sort out scarcity, it's hard to sort out a unique operating condition, and that's why you keep it in.

One final point. One of the reasons -- I'm not trying to be fussy about the words and just say I want it to be a complete definition, and maybe this is where there will be a difference here. Because I think market power is something to be proven, not just observed. You just can't go out and say, yep, that's it. You've got to prove it. And that's what I would hope we would do here.

MR. O'NEILL: Scott?

MR. HARVEY: A couple of things. There's some shorthand that people here I basically agree with are using, though, that I think may be misleading. The strawman, when it talks about market power, it notes that withholding output should be the key subject of monitoring efforts. And that goes to market power. Because we're not talking about raising price. We're talking about raising price by withholding output. And if there's no output withholding, if you're running flat out but you offer your output at a high price because there's a shortage, that isn't exercising

market power. And that's important that there has to be the element of withholding output, and we shouldn't lose site of that in the shorthand.

Secondly, some of these comments about profitability. We don't want to go through a profitability analysis of whether someone was profitable who exercised market power every time. But on the other hand, there is a phenomenon going on in the markets of Darwin awards. And people win them all the time. And sometimes it's net buyers that do something really stupid that drives up the price. Now was the net buyer exercising market power when they bid stupidly and raised the price at which they bought? No. They won a Darwin award. And the new employee won't make the same mistake.

And that is part of what's going on in the market. It's something that happens in a market. In every market, people talk about the worst thing is, no matter how good your business decisions are, someone else can do something stupid that costs you money.

And that relates to a third element of this, the difference between what is a significant price increase? And we mentioned the five percent. That's a five percent in the merger guidelines. And that was in effect when I was in the agency, but for all the oil refining mergers, we did not use five percent. We used a penny. Because any oil refiner

would have died for five percent of the retail price. That was five times their margin. So we used a much lower standard.

But on the other hand, we didn't say five percent above a simulated marginal cost. It was five percent over, John used the word, competitive market price. So we said what is the market price in the market pre-merger, and then we said is it going to go up by a penny? Not five percent over. We tried to rerun LP models and do that, but refining is very complicated just like electricity. And it's hard to capture all of the things that are going on in the real world. So you always come up with a simulation that's cheaper. If you could produce any product at the simulated price, we'd all be rich.

So that's one of the problems about using a five percent based on a simulation as opposed to the competitive market price.

MS. WOLFMAN: Allen, you had your card up before. I assume you still want to --

MR. MOSHER: Yes I do. Referring back to the discussion about mid-range capacity and about whether you can exercise market power. If you really had an unconcentrated market, it would probably be true that you can't exercise market power in the mid-range capacity. But the fact is we have concentrated markets. I know a

midwestern utility that when I did simulations when I was on Commission Staff that had roughly 20,000 megawatts of coal-fired capacity. And the variation between the low end and the high end was about three mills. Well, if there's no transfer capability there, they're dominating this market. Obviously they're never going to bid at the low end of that. They're just going to bid at the high end and try to raise the market price. And so they can make an immense amount of money on a very large volume but on a very small margin.

So I think it is hard to generalize between concentrated markets versus the unconcentrated ones. That's the first point.

On the definition of market power, I think the definition is fine. I differ with some of the other panelists on the notion of profitability. The problem here is that we have a hard time understanding what the profit function is for a lot of firms. I can give you lots of examples under the old monopoly model where I think investor-owned utilities have taken actions against municipals that by all sense should be irrational, should be unprofitable. What they're trying to do is foreclose us from getting access to some other market not directly, but by putting roadblocks in the way. Sometimes these strategies aren't clear.

In the case of Enron, there is the allegation or

rather the theory that an economist, McCulloch came up with, that it appears that Enron's behavior may have pushed up prices I believe it was at mid-Columbia in the forward market. And that may be driven by their needs to show profits on their balance sheet, not to make real dollar profits, but to sustain a forward price curve so that they can continue to post accounting profits.

I mean, how exactly are we to build that kind of model into our analyses? It shows that there are a lot of things about the behavior of firms that really we don't understand and that can be irrational from outsiders looking in but may be rational within. It sort of brings to mind Graham Allison's model, a book on the Cuban missile crisis. I mean, we're assuming a rational actor model of the universe, and in fact we have bureaucratic politics and political issues going on that may change behavior in ways that just seem very odd.

My great concern about the definition of market power tends to come in things like the metrics. How do we measure, for example, the difference between scarcity value and the exercise of market power? What it leads me to is to say that I don't think we're smart enough to differentiate in real short-term markets. What I'd like to see is a greater emphasis on the long-term market. And my real point here is that the purpose of restructuring from my

perspective and I think from most public power systems, is to push the long-run supply curve downward. To get the people into the marketplace that are better at building generating plants and operating them at lower cost.

The spot market, which we spend all our time talking about, is the residual. That should be where you do the remaining balancing. But the real savings is the next generation of power plants. It's the new technology. So we're looking a lot of times at the wrong thing. If we focus on those long-term issues, then a lot of the spot market issues will take care of itself. IPPs will have a vibrant market into which that they can sell. They'll have willing buyers. And they'll be contracting long-term in arrangements that ensure their profitability and ensure lower costs for my members. That's I think the direction we ought to take it.

On the sustainability issue, I think we ought to have intermittent but significant as part of the definition of exercise of market power. You can have a repeated set of price spikes by different actors where each of them go in, make a killing and get out. And if you can't remedy that kind of conduct either by fixing it through better market rules or by sanctioning their conduct, then you're going to lose market confidence.

MS. WOLFMAN: Why don't we take a couple more

comments from our panelists on the definition of market power, and then we'll take our morning break.

MS. EATON: I'll try to stick just to the definition. But I think that one of the problems here is not really the definition but using it. The Commission using the definition. Because we can all decide that it has to do with the power to raise price above a competitive price.

But as Scott said, we in the antitrust world generally have a benchmark which is pre-merger prices and post-merger prices. We're starting in almost all markets here with a noncompetitive price. We have no benchmark to measure clearly what the competitive price is. I think people sometimes don't think clearly about the respect we should give to a well functioning competitive market. I'm not saying they exist in electricity. But really, a competitive market is a huge computer for solving an incredibly complicated algorithm with just an extraordinary number of variables.

And any number that the Commission is coming up with to be that benchmark is going to be to some extent arbitrary just so that we can get a handle on it. But that means that there are going to be errors. If we say that it's incremental cost, if we talk about average cost, if we talk about trying to figure out intangibles like opportunity

costs, those things should be ideally built into any benchmark for competitive price. But those are very, very difficult to determine.

On the next point, someone used the term "acceptable measurement of market power", and I wanted to talk a little bit about the fact that under our guidelines -

- you know, the guidelines, you've seen them all. And they give a kind of screen or guideline for how high a price can go before we're going to care. And in fact, it's not a safe harbor. It's never been a safe harbor, and the reason is for the reasons that Scott said, it's an indicator, but you can't tell if five percent is enough or 15 percent is too much. And one of the ways that we tell in exercising our prosecutorial discretion on this point is what's the total harm versus what's the total cost of intervening in the market. And that's where you tell whether a penny is important, a penny is worth spending a year doing a merger investigation, or whether it's not.

And I think that you have to keep that in mind when you are worrying about safe harbors. On the other hand, if we don't have clear lines, you're just going to spend your whole time looking at every single time a price is higher than it was yesterday, and the whole system is going to collapse.

And I just want to make a comment about

sustainability since I said I liked that word, so I feel I have to say something about it. I very much agree that sustain doesn't necessarily mean uninterrupted and in a row. If you have somebody who can exercise market power for three hours every day in the summer, they're going to cause significant consumer harm and make a lot of bucks. But there's always going to be 21 hours in between that they're not exercising the market power. So that's not what I mean by "sustained". Actually I mean that it's going to come on a repeated horizon.

And finally, I just want to point out that we do have to look at the differences in the long-term market and the short-term market. I thought Allen's comments were very good about the long-term market. But I want to point out that if we can get demand-side responses working, if there is a demand-side response that we can put into effect, it's going to be responding to short-term markets. And so we really have to recognize that the demand-side stuff is really going to affect our short-term market functioning. Investment and entry is going to affect our long-term markets, and so it's important to keep your eye on both sets of markets.

MR. MEAD: If I could interrupt for a second. On the issue of measuring market power, I can certainly appreciate that it's often difficult to determine exactly

what the competitive price is. But if we observe, whatever the market price is, if we observe significant capacity idle whose marginal cost is below whatever that market price is, could we not conclude that this may be an exercise of market power?

MS. EATON: The problem I have with that, I think that withholding may be a more efficient function for you to look at. I mean, you're more likely to find a problem where there's clear withholding than just high price. But that doesn't mean that actually withholding is as simple as it seems. Because opportunity cost still goes into that. People can be not running a unit because in fact there's an opportunity cost to turning it on now if they're going to have to shut it down very quickly.

So you really have to recognize that withholding also has these intangibles involved, particularly the opportunity cost in this industry of ramping up and ramping down before you can decide that just because some level of operating cost has been met if you don't turn it on, you're withholding and exercising market power.

But I think it's probably a better indicator in these markets where there's a lot of scarcity to look at places where there's been withholding.

MR. GARBER: It seems to me there is a concept missing here in the definition, and that is one of intent.

Now I don't mean to introduce legal jargon into the bailiwick of the economists. But maybe with respect to electricity markets, short-run electricity markets, there ought to be the idea that your action in exercising market power was intentional, intentional to raise prices.

For instance, in California the generators have freely admitted or stated in many of their pleadings that they withheld generation to guard against outages in their portfolio. And this was at the time when power was most scarce and the ISO was trying to find reserves to meet its operating reserve criteria. And at that very time we had redundant reserves being withheld because apparently the market design made that rational behavior to guard against the possibility of an outage within your own portfolio.

Now it doesn't seem to me that that is per se an exercise of market power, but it seems like to me it is a market design phenomena and incentives that led to very bad results. And when scarcity is not present, the cost of that would just be inefficient, perhaps not catastrophic. But when you're talking about at the margin, like everything interesting happens at the margin, where redundant reserves for outages can be, you know, quite costly.

So I'm wondering if for the short-run electricity market there ought to be the concept of intent introduced.

MR. O'NEILL: Don, could you be more specific?

Exactly what rule caused this redundant thing, and is there a fix?

MR. GARBER: Well, it's my understanding it had to do with the way the ISO procures ancillary services and regulation and so forth. I suppose the risk has been placed on generators of an outage. And they have chosen to shoulder that risk by having physical supply withheld from the market to guard against an outage. And that seems to me to be, when you look at the overall market design and what the ISO -- the ISO doesn't know that. They don't take that into account, so they try to procure ancillary services on top of that.

And so at the very time when we needed every last megawatt to be available, we had an inefficiency here that on one hand might look as like classic withholding, but it could well have been with the best of intentions.

MR. MERONEY: Is it just as much a question of avoiding designs that create bad incentives so people are just responding to the incentives as it is a question of intent?

MR. GARBER: Well, maybe you can take the intent element out of it if we in fact create good designs so that the incentives always lead us in the direction we need to go, and then when we see deviation from those incentives, then perhaps you can conclude that you have found an

exercise of market power.

Until that happens, I think you have to, you know, the question is, if you have a bad design, can in fact you punish a supplier for responding to that bad design in a way that is not intentionally to jack up prices but simply to protect themselves from some economic downturn?

MS. WOLFMAN: Go ahead, Sonny.

MR. POPOWSKY: I just wanted to echo a point about, the question is, what are we using the definition for? And I think I would agree with Joe Bowring's definition, particularly, and I think more interesting part of it is, not that market power is when you raise prices above competitive price. But then the question is, okay, how do you define competitive price? Which I think Joe defined initially as the short-run, short-term incremental cost.

Now I think if you actually look at the PJM market monitoring report, that doesn't mean that every time you go above short-run incremental costs that, you know, you go directly to jail. What it means is is that the market monitoring unit has something to look at. So I don't know if you can see this, but this is the frequency of prices in PJM in the year 2000. It's sort of the inverse of your classic hockey stick curve. And lo and behold, about 8,691 hours or 8,700 hours a year, the price is below 13 cents a

kilowatt hour, which is I think about the highest cost, the highest incremental cost on the PJM system.

So for those remaining 60 or 70 hours a year, that doesn't mean that something we ought to look at. And what you find when you read the PJM monitoring report is that in most hours, there is a rational explanation for those high prices: Opportunity costs in nearby territories, shortages. But if you go back, for example, to July 1999 when the price went up to \$935, there really is no good explanation other than the possible exercise of market power.

So using this definition is really just a tool I think to decide what hours and what events to actually focus our concern on. Not so much to say that that is a definition of wrongdoing. It's a definition of something that we ought to be looking at.

MS. WOLFMAN: Let me say that we don't want to be cruel to our panelists. We've run over, but we had promised you a break. But we have people who need to leave at noon, too -- and panelists, too. Do we have any panelists who would like to take a break? We could do a short one right now. Okay. Three minutes. Panelists can use our staff rooms off this way. We'll be back in three minutes.

(Recess.)

MS. WOLFMAN: I see there are people who would

like to continue on the panel to talk about the definition of market power or more importantly, when we intervene in the exercise of market power. And it is a topic I know that can take all of our time. But in order to cover a little more, can we briefly see if we can't, you know, if you have a few points you want to make, we can do that. But I do want to get to the question of what are the important elements to be in a market design to mitigate market power. Everybody says it's important to get it right at the start. What is it we need to get there at the start? And I don't want to lose sight of the need to discuss that question.

And my preference, unless somebody really has something you want to pick up on on our prior topic, would be to start right now with that question. Does somebody want to offer us some helpful suggestions as to what should be there at the start to get the market design right? Joe?

MR. BOWRING: I listed a few a few at the beginning, and let me just continue with that. I think these are in fact all part of PJM's market or became part of PJM's market. And I think one caveat to all of this is everyone tries to design the best market they can, but one of the things I've learned even at PJM is that there's a constant need to evolve the rules and to evolve the market design.

In any event. So we started off with the nature

of the energy market, the energy market cap. And the energy market offer cap also has to take explicit account I would say of operating reserves and the way you treat startup and all the bids.

PJM also has a rule that you can only submit one offer for the day. And I think that's actually a critical rule. It may be at some point we outgrow the need for it. But analytically, you can think of that as increasing the uncertainty of the demand to the suppliers. If they want to be dispatched, if they want to run, it increases their incentive to bid or offer competitively. In addition, we have the local market power mitigation rules.

Another feature of the market that's not often talked about in the context of market power is the ability and authority of the RTO to coordinate outages, both for transmission facilities and for generator outages. And that, as I hear from California, can be a critical issue. And that has certainly helped the competitiveness of PJM markets.

We also heard some about capacity markets. If the design includes a capacity market, which I actually think is important in and of itself to enhancing competition for a couple of reasons, but one is that it provides explicit limits on withholding and day ahead. And in addition, it provides an incentive not to physically;

withhold, because you affect your outage rate and therefore you affect the value of your capacity. I think we've seen those incentives work in the PJM market.

Another feature, again, just to tick through these real quickly, is access to FTRs. That's something that PJM has not done probably as well as it should have. We're moving in the right direction. But access to FTRs is critical for retail access, critical for people to be able to compete for retail load and having those FTRs available to anybody who wants to pay the price of them is an important part of ensuring ease of entry into the market, particularly the retail market.

Having a well functioning and efficient generator interconnection process is critical. Again, that's a condition of entry. You have to be able to enter the market. You have to be able to do it under known rules. You have to be able to do it in a relatively efficient manner.

And finally, I would just add that there have to be rules governing the way DSM is treated. And I would just put that under the general heading of DSM facilitation. I don't really think it's the job of the RTO to literally be in the market for that, although some have accused us of doing that. I think it's our job to facilitate it to make the accounting easier, to make it easier or to in effect

make a market in DSM. We also have to just be careful that making that market is consistent with good market design rules and doesn't throw money at the problem rather than dealing with the design issues. So that's my quick list.

MS. WOLFMAN: Do other panelists want to address this?

MR. ROACH: I think it depends. There are two levels. Structurally, what I would call structure, some of the same things Joe mentioned. Definitely one of the things you want to be sure of is to keep a lot of people away from the spot market, a lot of people that don't want that risk. And what does that mean? That means you've got to have forward contracting. You've got to keep new entry coming in. What does that mean? That means you've got to have the right interconnection policies. And I'd like to really see more invitations to bid longer term contracts. I'd like to see somehow getting more competitive bids where merchant plants and utility built construction can compete on an apples-to-apples basis.

Demand response obviously. You just have to create that opportunity and a capacity requirement that creates value. And there's lots more in there. But in terms of structure, those things are really essential I think for setting the market up right.

In terms of mitigation, if your question goes to

that, you know, again, with the political reality that we're going to need some, then I think the strawman paper lays out three possibilities of mitigation. It would be important that that's kind of it. That that's not just a starting point and then everybody adds on top of that. A locational offer cap has a proxy for demand with this kind of option pricing that I talked about, trying to get it competitively determined. I think there's some possibilities there. And something that will go away once we have demand response. A maximum offer cap can go on the \$1,000 price cap that's in place. Again, a threshold where that would go away.

And I've confused those two, actually.

Locational offer cap for RMR service, a maximum offer cap. And then some sort of price screen, if that's necessary. If the first two really do the job, we wouldn't need the price screen. But a price screen as I described earlier.

But those three might be a place to standardize a design. And again, not looking for more than that. That would be it.

MR. O'NEILL: Craig, excuse me, your structural list didn't include divestiture. Was that intentional or was that accidental? And I'd like to know, since John's list is structure, structure, structure, whether that includes divestiture.

MR. ROACH: That's actually a good point. You

just can't have competition without competitors. So that practical point means that in many markets, you're going to have to create those competitors. And I think divestiture is one way to do that. It was on a roll for a while. It's no longer on a roll. But I would certainly include the goal of having sufficient number of competitors. Divestiture is one way to go there. Certainly facilitating new entry, new merchants, is another one.

MR. O'NEILL: I'm not sure what our legal authority is, and I won't even attempt to. But suppose we didn't have that authority and we found -- what would we do then?

MR. ROACH: You're looking for something in the interim if you can't do that.

MR. O'NEILL: Well, no. It's not an interim problem. It's a permanent problem until it gets corrected. So what would we do?

MR. ROACH: I don't have a solution for all of it, but I'll give you one that's in this handout here. You may not be able to allow market-based rates in those areas. But to have a positive opportunity, what might go on is -- say we have a utility. It underattests, has market power. Not allowed market-based rates. But could there be an opportunity where you would allow that? Again, I would come back to a true competitive forum. If they came out, if that

utility came out, for example, and said look, we're going to competitively compete to all our new needs and our replacement needs, and we're going to run this fair and square. We're going to have only our unregulated affiliate can bid. We're going to have a third party reviewer, evaluator and a few other things. Then maybe with that forum in place, that could be an instance where if that utility won in that instance, it could have market-based rates.

MS. WOLFMAN: Scott, you wanted to address what we need to have?

MR. HARVEY: I agree with a lot of what Joe had to say. First minimum interconnection standards are great in the long run, but we've got to realize they won't solve the problem.

Secondly, an extreme damage control price cap is a reasonable step to have, but we should have no illusions, that isn't mitigating market power. That's just saying that if we have a shortage, you can't charge the GNP of China or the United States for the last megawatt. And it doesn't solve market power. It's just suddenly we're going to limit the exposure of generators and everybody in that shortage situation.

And then thirdly, I agree with John. If there's market power, you ought to do divestiture. And the hook

would be, if we have a vertically integrated IOU that has 15,000 megawatts of generation and 12,000 megawatts of load, they don't have an incentive to exercise much market power because they use their generation to meet load. If they come in and say we want to split those up and we want to have 15,000 megawatts of generation and we're just going to let this load go out there, you've got to look real hard at what the market power is. It should no longer be the game of let's fool FERC. And you ought to put some burden on the people that are doing that divestiture and make sure that we really have an analysis of the impact of that split up, and if necessary, make them split that 15,000 megawatts of generation up into five parts if they want to keep market-based rates.

MR. O'NEILL: And if they don't want to split it up?

MR. HARVEY: If they still have 15,000 megawatts of generation serving their 12,000 megawatts of load, how are they going to exercise market power? I think you have a hook when they say we want to decouple.

MR. O'NEILL: And suppose they don't want to divest?

MR. HARVEY: If they don't want to divest and don't want to divest their load, I don't think there's any market power. I'm not persuaded that if you have 15,000

megawatts of generation and an obligation to serve 12,000 megawatts of load, you've got market power. It's when you've got 15,000 megawatts of generation and no longer are obligated to serve that load. The obligation to serve is like a financial contract for differences that mitigates your forward market power. When you split those up, it's like you tore up the contract for differences. And that's the point where you ought to ask some hard questions and say, is this firm so small that we don't care about this? Or it's not so small.

MS. WOLFMAN: I see we have some panelists that want to react.

MR. PATTON: I want to elaborate on that. That's absolutely true. And I think Craig alluded to this earlier and his concern about the SMA test. What you need to think about is the degree to which a supplier is a net supplier in the market. What would be even more compelling, what Scott is saying is if you had 12,000 megawatts of generation and 15,000 megawatts of load, you clearly then -- it's questionable that you have market power because you're a net buyer under all circumstances. And you're likely the person who's filing petitions at FERC saying we think market power is running rampant because you're out there buying to try to meet your load.

So in the context of divestiture, you have to

keep in mind how the incentives change when you divest. If you simply separate the load and the generation, you're probably taking a step backward, because you create a huge net seller and a huge net buyer. The net seller now has significantly different incentives than they had when they joined. If you're going to engage in divestiture, it's going to have to be one that effectively divides the generation stock enough so that you're achieving a net benefit in terms of mitigating market power.

I have some other comments but I just want to respond to the divestiture point, and I'll circle back.

MS. WOLFMAN: Allen? On this point, structural elements that we need.

MR. MOSHER: I want to make a suggestion that we may need two standard market designs at a minimum. One of them responds to the fact that much of the industry is now and will likely remain vertically integrated as far as the generation local delivery and retail sales functions. There is no national consensus in support of retail choice and divestiture. There is retail choice in the offing in a number of states, but that isn't a consensus.

So to assume that a model that was developed with retail choice as its foundation point, as in PJM, New York, New England, could be somehow modified to fit a vertically integrated structure in most of the states in the U.S., that

seems well nigh impossible. It's like trying to convert a car into an SUV with four-wheel drive and taking it out on a muddy road. You could try, but you're going to get stuck.

So we ought to think about how the market works where it's vertically integrated. It's correct that if you keep the obligation to serve for most of the capacity that a vertically integrated utility has, it's committed to serve native load. And to the extent that they're doing cost of service at the state level, there's not really an exercise of market power. There may be inefficiency because they're not procuring at least cost, but that's not the same kind of market power.

But what you do have is a lot of market power in the residual -- not the residual market, the surplus market. And my members are very much subject to that. Unless there's an obligation, for example, to sell the same kinds of requirements energy services that we used to buy from vertically integrated investor-owned utilities, unless that's out there, we're back into the bulk power market. And we're faced with situations where there's no ATC, no firm ATC. There maybe nonfirm. But that's not a substitute. And two or three suppliers that can get to us, or sometimes only one.

Now what you're reduced there to is two options. You build yourself -- or actually three. You build

yourself. You find an IPP that somehow can build there and get through the hurdles, or you buy from the incumbent, which has, by the way, a lot cheaper capacity that's been there for a while, has a big strategic advantage there.

We need a different market design I think that reflects that fact that the competition may be over a much smaller share of the capacity.

On to some other points. The bid offer curves that I know about for power plants probably ought to change seasonally. Not every day, not every hour. They change seasonally. Because they depend really -- well, actually it does depend on the unit. There's ambient air temperature can make a big difference for combustion turbines and combined cycle plants. But for coal-fired capacity, the heat rate curve really only changes when the cooling water temperature changes.

There may be some derating problems, but that doesn't change your offer price. You've got this big coal pile out there. You bought that under a long-term contract. That isn't going to change.

MR. O'NEILL: Shouldn't the calculation of marginal costs be on the spot market price of energy and not the pile price, so to speak?

Suppose you paid \$50 in MmBtu for the coal.

MR. MOSHER: You're right, Dick. I'll agree with you that it ought to reflect market prices, but we don't see that same kind of volatility in coal prices. It's pretty stable out there.

MR. O'NEILL: You do see a lot of volatility in gas, mostly, but even gas prices are daily. People procure day-ahead. So the idea that you have a different gas price for two o'clock, or a different energy price for two o'clock in the afternoon versus 10:00 a.m., I haven't seen a good rationale for it. Perhaps you're going to offer one.

(Laughter.)

MR. WOLFMAN: Do you just want to jump in and offer yours?

MR. HARVEY: In the Northeast, and also in California, we have open access to gas transportation systems. People have to schedule gas day-ahead. If they haven't scheduled it, and then they want to burn more gas in real-time, they often pay extremely high prices. So you can think of it that they've got so much cheap gas. Once they've burned it, it's an order of magnitude higher.

So you've got to raise the prices. I disagree with Joe, but I think the price has got to vary. Niagara Falls, if you told Niagara Falls they had to give New York ISO the same bid price all day, they'd show us a more

restrictive bid curve. They've only got so much water. They price it out. The more flexibility they've got to change their bids depending on how much water they use later and how much water we use of late, the more flexibility they can give the ISO.

That's what the ISO lives and dies by is more pricing flexibility. And if I've got market power, those rules won't stop me. If I were in PJM with those rules and I had a lock on the market, I'd bid my capacity at a higher price than I'd self-schedule in real time. Self-dispatch. And I'd achieve that purpose.

In reading Joe's report in '99, I think they bid it in at 8.50 and when it was out of the market they self-scheduled it.

MR. MOSHER: If I could continue for a couple of points.

(Laughter.)

MR. MOSHER: I'll go briefly here. Most APPA members don't like the idea of vertical integration. Leaving transmission aside, we'd like to be integrated all the way from long-term purchases all the way to serve-load because we're really load-serving entities.

We represent our customers. We stand in their shoes. We're the canary. We're the bellwether for whether this restructuring is going to work. Because if we can't

make it work, we've got a problem generally for retail choice. And I'll get off the soap box.

One of the things that goes with this thing is getting a market for long-term FTRs, if we're going for that model. If municipalities want to buy from a remote source and they can't get firm ATC under the old 888 paradigm, and under the new model they can't get long-term FTRs that have some match-up to the life of the unit, or the life of the contract, we're bearing an immense amount of market risk.

A member told me a story last night. When they went up for procurement in New England, they had a very hard time getting buyers to come forward on other than a seller's choice for delivery points.

They wanted to go to the new, I guess there's a new New England hub they're trying to create and they couldn't fill the solicitation for a five-year contract running 2005 to 2009. That's partly uncertainty, but it's also because they don't have the FTRs to ensure the deliverability.

So if we go that way, we've got to have long-term FTR buyers.

MR. WOLFMAN: Jade, you wanted to comment on the structural points?

MS. EATON: I'll be brief here, because everybody's been making such interesting and good

discussion. I just wanted to talk about the net seller/net buyer point people have been making, and about whether if someone is a net buyer you just don't have to worry. And therefore if you have a load serving entity that's vertically integrated, you don't have to worry.

I would point out two things about this. First of all, vertical integration doesn't tell us very much. If everyone in a market was vertically integrated but nobody controlled any of the load, or a substantial segment of the supply market, we wouldn't care that they were vertically integrated.

The question is whether you have a significant concentration in the generation in an area, and then you're vertically integrated. Then you have both the ability to exercise market power directly, which is bad, and you have the ability to keep people out of your retail market, which is bad. So you have bad/bad.

If you did not have the power in the supply market, you wouldn't be able to keep people out of your retail market and you could try--you could win the Darwin Award and keep charging high prices and you'd just lose all your customers.

So it really isn't whether you're a net buyer or a net seller so much as where you face competition. I think that is very important. Because one thing that worried me

about the idea that we're not going to worry too much about whether we've got markets where somebody's a net buyer is, first of all, are we assuming that we are not going to have retail competition?

I think Alan's point about making sure that we know which kind of market we're dealing with is important. But I would say that you have no less incentive to be very careful about having competition where there is no retail choice, because where there is no retail choice then buyers are only going to be able to get through their own regulatory process an efficient price if there is some benchmark price.

And if you have an area where the local retail utility owns all the generation, we are just back where we were. And you have to have cost-of-service type regulation. You are going to lose all the efficiencies of demand and price response that we have been trying to get into this market.

You really have to keep looking at the fact that the wholesale market is a vehicle for getting a good competitive retail market.

Then the other thing that I would point out is that if we're going to hope for divestiture, if there is a means of divesting assets in the generation market, we have to look at the kinds of assets that are divested. And this

really has happened in terms of states which have required divestitures. But it could come up in the context of remedies in your merger cases.

And that is, somebody who divests most of their marginal capacity retains all their baseload but keeps a critical amount of mid-merit capacity.

If you look at all the concentration, it looks much less concentrated and you may have created a huge incentive for greater market manipulation than existed before. So you have to look at the portfolio of assets, not just the total output. But that's kind of old news, but we have to keep remembering that.

MR. WOLFMAN: John, did you want to address this?

MR. HILKE: Just a couple of quick points.

The question came up: If you can't get divestiture, what are the alternatives? Basically the alternatives are entry or increasing the size of the geographic market. Those things may not happen very fast, so divestiture is still at the top of the list.

But if for political reasons, or for legal reasons, you don't think that's possible, then you have to spend a lot of attention on entering conditions and transmission bottleneck relief, and so forth.

The last point I wanted to make is sort of another one of these plea things. It is really that if you

are going to end up with a bunch of mitigation rules in your markets, there ought to be some feedback between those being triggered and your taking other steps.

That is, if you set a ceiling and you are repeatedly bumping up against the ceiling, that ought to be a signal that you ought to do something about relieving transmission bottlenecks or encouraging entry in that particular area so that it doesn't just become only a short-term thing that you never get back to. But in fact there is a trip wire for you to work on the structural stuff whenever those things get triggered.

MR. O'NEILL: John, let me ask a structural question. Suppose this was 1998 and we were about to embark on California. What structural screens would you have used, assuming we had all the authority we needed to order divestiture, to get us to a competitive market?

MR. HILKE: I am not going to be able to tell you exactly, obviously, but the types of things which we would look at are basically, as Jade mentioned earlier, we need to look at basically ownership patterns within the whole array of supply characteristics and try to make sure that the divestitures that you do create multiple suppliers at each place where the demand curve regularly intersects the supply curve so that you don't end up with sort of a monopolist amongst the mid-merit plants and another monopolist amidst

the peaking plant, and another one at the baseload plants.

But whether you have lots of competitors in each of those situations, and that you try to eliminate the things which prevent imports from other areas which would allow even more suppliers to come in.

MR. O'NEILL: In the graph that Sonny put up, it was just a few hours that seemed to be problematic. Jade, I think, talked about three hours persistently on every summer day. Do you just not deal with those? And how do you use structural remedies to get at the 60 out of 8000 hours a year?

MR. HILKE: Basically you have to realize that each of the different hours may end up essentially with a different geographic market. So you have to try to look at an array of those conditions so that the mitigation that you do basically protects you in each of those situations.

MR. O'NEILL: It's my understanding when you do structural remedies it's for all hours, not just for the 60 hours. So that we would be doing a structural remedy for 8000 hours when we only needed it for 60.

MR. HILKE: Potentially if it's a big enough problem that arises in those 6 hours, this question about duration isn't of so much importance as how big is the transfer of wealth relative to what the mitigation costs are. It's sort of a cost/benefit thing.

MR. ROACH: Can I just answer the question about California? I think the point is that structure includes structure as you're saying, how many competitors do you have? And you are right to focus on that. But structure in this business right now also includes market rules.

If you ask me if I was lucky enough to be back a few years and I could make California not happen, what would I have pointed to? It's pretty obvious. One is a rule that forced everyone to buy in the spot market. That's bad structure. A rule that forced utilities like Don's utility to sell at a fixed price and buy at a variable price. That is bad structure to me.

A rule or somehow a culture that did not allow the impending capacity shortage to be addressed, to me that is part of structure along with antitrust structure.

MR. WOLFMAN: You are echoing David Patton's original point, that it is very difficult to distinguish between structure and the rules.

MR. ROACH: He's right. It is very tough.

MR. PATTON: I appreciate that.

(Laughter.)

MR. PATTON: With Joe going first, I guess I put myself in the position of being able to not take much time to agree with a lot of the design elements that others have mentioned.

I want to focus really on one thing in particular, and that is the bidding flexibility issue. In your paper you have alluded to the point that I want to make.

First is that bidding flexibility provides significant benefits even over the course of a day. And I agree wholly with what Scott Harvey had said, especially for those resources that are your peakers that are expensive because they're not going to be scheduling their fuel day-ahead, and they honestly do not know when they get to real-time whether they might find someone who has nominated pipeline capacity and buy it in the spot market cheaper, or if they have to pay these penalties then they get much more expensive.

Allowing bidding flexibility then accounts for fluctuations in true marginal costs. That prevention mitigation scheme from artificially depressing prices or, in the worst-case scenario, attempting to force suppliers to bid below their marginal costs and having to resort to other actions to try to escape the harm that you are imposing on them, but reducing bid flexibility is probably the primary way of getting at economic withholding.

The principle for mitigation in my mind, the number one principle, should be that your mitigation should have no effect on suppliers who are behaving competitively,

or the market in general. And so there are mitigation measures that artificially supersede the market, and there are others that do not.

Limitations to bid flexibility are entirely consistent with the types of market designs that you all are proposing. The one innovation that I think is important, though, is that limitation on bid flexibility be imposed on the basis of a relatively substantial set of hurdles that justify the limitation.

So rather than an across-the-board locational offer cap, for example, that offer cap should be triggered when the predicates of market power actually exist. It goes beyond just the presence of transmission constraints. New York City is a great example.

New York City can be a location where the competition is extremely limited. When constraints are binding into the City at certain load levels, you will have must-run problems. At lower load levels, though, you may have transmission constraints and you have five suppliers in there and there's lots of excess capacity, and there's really no reason to be artificially constraining how the generators bid.

So you've mentioned in your paper conduct and impact thresholds. Those thresholds which have been in use in New York are extremely useful at focusing your

limitations on bidding to only those periods where there is a substantial concern because we have to understand that our measures for withholding, if you are focusing mitigation on withholding, are imperfect.

And so when you trigger mitigation, there ought to be a fair error band built in so that you're not triggering mitigation and risking mitigating people unjustifiably and intervening. That is when you undermine the functioning of the market and affect investment.

MR. MEAD: On the subject of the triggers, some people have suggested that supply tightness is one structural condition that gives rise to market power periodically.

Do you think some measure of supply tightness such as reserve deficiency or something like that might be a useful trigger for triggering mitigation?

MR. PATTON: The conduct and impact test accounts for that implicitly. That is certainly one way to do it. The way it is done in New York is, if you had a relatively large threshold for conduct, and so we use as a benchmark a competitive bid benchmark, the average of the accepted bid when constraints are not binding over the past 90 days, and that provides I think a more accurate signal on what the marginal costs of what various output blocks in the market are.

Then we apply \$100 a megawatt hour. Most of these reference prices are \$50 or \$60. So this is a relatively large band. And it takes account of a lot of factors that could cause your marginal costs to swing.

But then on the impact side, what we do is when mitigation is being considered, you can estimate prices with and without the mitigation. And what will turn out is that where you have the significant price impacts, or in periods where you have a relative supply tightness, so you're accomplishing the same thing. But it's a more correct measure of the market condition.

MR. WOLFMAN: I know John has to leave, and he does want to say something. So I want to give you that opportunity before you have to go, and it looks like Joe wants to respond to Dave Patton.

MR. HILKE: Thank you for interrupting the rest of this for this. The important thing here really is that when you're looking at a choice between different approaches, structural is really very, very attractive relative to behavioral constraints.

You may have to use behavioral constraints, but using the behavioral constraints and then feeding them back into what you try to do structurally makes a lot of sense.

The other thing is that, without having some sort of demand responsiveness, a lot of the signals for people to

take actions in terms of distributed generation and other forms that might relieve some of these market power problems really are being short-circuited without that.

So I really emphasize the importance of trying to work with the states to try to increase the amount of demand which does face variable prices. With that in place, a lot of these problems will tend to fade and may fade very quickly if some of the models are correct. Without that, some of these things may persist sort of no matter what you do.

I just would put at the very top of everybody's agenda working with the states very aggressively to try to get more demand facing variable crises. That's it. Thanks.

MR. WOLFMAN: Thank you. And I recognize you may have to leave, but--

MR. O'NEILL: Can I get a clarification? Scott said something that really sort of stuck with me: that if you don't buy a day ahead in the gas market you paid an order of magnitude more?

MR. HARVEY: All the uncertain circumstances. When the pipelines are curtailing and they announce there are certain times of the year in the Northeast and in California where they announce you've got to schedule it; we're short. If you don't, penalties are in effect, and you know it. You know when those days are.

MR. O'NEILL: So the price then goes from \$3 to \$30?

MR. HARVEY: It means if you schedule a day ahead you pay what you pay.

MS. FERNANDEZ: Could I ask something else? How many of those plants have flow control on them? In almost any new gas-fired generation plant, pipelines insist on having flow control put on the plants. That allows the pipeline to electronically control how much gas can be delivered to them. Because--

MR. HARVEY: That's not the point.

MS. FERNANDEZ: No. The point is that looking at OFO penalties that are never supposed to be charged, and looking at that as a cost and as an explanation as to why that generator might have to pay a price for gas, seems a very strange way of doing it. Because there are ways of electronically controlling how much gas is taken out of the system, and that is what it will trigger.

MR. PATTON: Let me jump in on Scott's behalf.

It's not just the pipeline penalties. If you haven't arranged gas supplies and you can't arrange interday supply by somebody who's nominated, then you're buying it from your distribution company. And at least one penalty I'm aware of is the high day-ahead price times 67 percent on top of that.

You can easily, if you have a mitigation measure that forces the bid down to 30 percent below their true cost of operating, what will happen is you force that generator to run and then your flow control is sort of meaningless, because you've told them they have to run. You have to pay whatever the price is and they're running below their cost.

You want to have enough room to reflect those things. But that only really gets to be a problem if you think your mitigation is designed to address short-term, \$5 price increases or \$10 price increases.

If you have a larger band so that you're trying to focus on really the significant issues, you can escape that.

MR. O'NEILL: Scott said the price goes from 3 to 30. My guess is your band is not going to capture that.

MR. PATTON: He was talking about a different set of penalties.

MR. O'NEILL: Would a day ahead market alleviate

some of these problems?

MR. HARVEY: We're talking about bids being the same. Day ahead, there's no problem because you're going to be able to schedule it. The question is, if you've scheduled 100 megawatts in that hour day ahead and then we're going to say we want you to burn more than that, they're going to have to show a different price than you bid in day ahead, because you're going to have to pay penalties.

So your bid curve needs to be different for anything -- and you can say, well, we just won't run, but that's not good for the ISO. You say, okay, I'm willing to pay the penalties if need be.

MR. PATTON: Day ahead doesn't really solve it. Because most of the units we're talking about are selected as reserves. There are certain circumstances where you will forecast day ahead. You need them and then you'll give them a schedule. But most of the time you're calling them on in real time.

MR. O'NEILL: Do we want to basically have a marginal cost that reflects the cost of stealing?

(Laughter.)

MR. O'NEILL: Most of the penalties are assessed because people are stealing other people's gas during OFO conditions. So I'm not sure that we want the ISO directing the generator to run because they're taking somebody else's

gas.

MR. PATTON: But if you mitigate, if you mitigate below a level -- if you mitigate, you're going to force them to run. You're going to force them to steal the gas.

MR. O'NEILL: I don't want to do that.

MS. FERNANDEZ: That's what flow control is for, is to stop them from stealing.

MR. BOWRING: Can I just add something as well about the mitigation? Let's say in PJM under our rules with cost capping for must run units, you have a unit in this situation, a unit which was not planning to run, was not scheduled but is must run for transmission. In fact, we permit multiple cost schedules to be submitted, and the actual cost of purchased gas would be reflected plus a mark-up. It's not all that difficult to deal with.

As far as the more general issue of bidding flexibility, clearly there are tradeoffs there. I think one reason for having the kind of particular mitigation structure that's in New York, for example, in place is in part to offset the sometime impact of hourly offers. So they're clearly tradeoffs. We have not found in fact that it's had any negative impact on the way we actually run the system. The ambient air conditions for CTs can be dealt with. It's a simple adjustment that's already in the bid curves. Hydro self-schedules. It simply has not been an

issue.

MS. WOLFMAN: I know Jade has been wanting to get into this for a while.

MS. EATON: To get back to Dick's question about how structure can deal with the three hours every afternoon all summer, I have two answers to that. First of all, if the price rises, there are peaking units that actually will come in and be very cost effective to only run 60 hours a year. So that's one answer. That's an entry traditional structure kind of view.

But the other thing I really want to emphasize is that demand side is part of the structure, and that that has to continually be thought of because it is my personal belief that the only way we can effectively stop the problem of three hours every afternoon is by a demand kind of response as opposed to building a 150 megawatt power plant. That's why when people start talking about retail markets as if they're going to remain strictly cost of service average cost pricing forever, we are really just signing our own death warrant here. We must be able to have retail, significant retail demand-side responsiveness. Because if you limit structure to entry, we're going to have a lot of problems in those critical hours.

MR. O'NEILL: There are lots of people who tell us that that's not cost effective. I'm not saying that I

believe that.

MS. EATON: Excuse me, that what's not cost effective?

MR. O'NEILL: Demand side response mechanisms are not cost effective.

MS. EATON: That would have to be just in this industry as opposed to the world at large then.

(Laughter.)

MR. O'NEILL: That's what they tell us.

MS. WOLFMAN: Craig?

MR. ROACH: Would it be okay if I went back to Dave Mead's question? I thought he raised the issue of scarcity, and I think it's really central here. If I heard the question right -- and what I'm trying to get at here is what's the problem and what's the right policy response.

If I heard your question right, it was about a situation in which there's really scarcity. There are customers that want 100 megawatts and only 90 megawatts to go around. At that point, the price in the marketplace, as you know, doesn't have anything to do with production cost. It has everything to do with customer value. And the price has to rise to a level so that ten megawatt hours drop out.

And why I say that is, if that's the nature of the problem, then the Commission's policy response to that is in the interim to perhaps have the \$1,000 bid cap. And

the structural response is to go get demand responsive bids or prices.

And in that way I disagree a little bit. I don't think the price screen is the way to go after that problem. And it's not an issue of market power. In a fully competitive market, the price would rise to a very high level because it has to clear the market. That price rise is about a shortage, not about market power.

MR. MEAD: I'll hear from Dave in a minute, but I was concerned not only about the situation you raised where supply is absolutely speaking less than demand, but also situations where supply is a little bit greater than demand but not by very much. So you don't have an absolute scarcity, but supply is quite tight.

MR. ROACH: Just real definitionally, I think that if you need X percent reserves to supply customers reliably, the notion of a shortage begins once you dip below X. So a little bit, a lot. You define what -- if we lose operating reserves, we're into a shortage.

MR. PATTON: I was going to make that point. The one thing about the conduct and impact test, though, that I think hopefully will make Craig feel better, is it guarantees that you don't have mitigation when you get into a shortage. And the reason is that the economic withholding that you've detected, mitigating it will have no impact.

If you truly have reference prices that reflect that there are \$800 or \$1,000 resources in your market and you're at the end of your rope so that you're dispatching them, the fact that a generator raised its price from \$50 to \$200 makes no difference whatsoever. And the mitigation in New York in fact under the highest load period almost never occurs. It triggers when you're not in shortage, but there's a significant amount of withholding to take you to a shortage-like state.

The other issue I was going to raise was the one Craig raised. You never run out of power. What happens is you start running out of reserves. That's part of this market design that we need to grapple with. When you run out of reserves, the question is, how much am I willing to pay to try to maintain my reserves? And whatever I'm willing to pay to maintain my reserves, that's the value you should be paying all the energy providers as well, and those market rules are not well conceived in the current markets. We really need to focus on that in order to get the right shortage prices reflected in the energy market.

MS. WOLFMAN: We have a panelist who wanted to get into this I thought.

MR. POPOWSKY: Actually not that point.

MR. MEAD: If I could just pursue one question for a second then before we take your comment. I certainly

appreciate that during periods of scarcity, marginal costs are higher and prices should legitimately be higher. The concern I have heard expressed sometimes, though, is that during periods of supply tightness where there's a little bit more supply but not a lot, that some suppliers become pivotal. And while the price should be high that, you know, they are either economically or physically withholding some capacity so that the price is higher than it should be, Craig or Dave, are you suggesting that that's not really a significant problem?

MR. PATTON: That's the kind of problem that the mitigation does effectively address, when you're not in shortage, but you're close enough to being in shortage that a large supplier can take you there by withholding. So that's really what you're trying to address. That happens far less frequently in broad market areas than it may happen in more isolated markets where transmission constraints reduce the number of competitors and create these pivotal suppliers.

MS. WOLFMAN: Sonny?

MR. POPOWSKY: I just wanted to respond a little bit on the demand side discussion because I agree with Dick and Jade that we have to do everything we can to get the demand side into this equation. But what I worry about is any suggestion that we just need to send these price signals

to residential customers. Hey, the price this afternoon is \$1,000 a megawatt hour, you know. Okay? Now what do I do? I'm sitting here in this meeting, and I probably have a laptop computer, but most people don't. Most people, just sending these price signals, we can cause a lot of pain to residential customers by sending them these variable price signals. But unless people really have the ability to do something about it, then that's all we've done is caused a lot of pain, and I don't think that alone is the answer.

MS. EATON: I just wanted to respond. Price signals to somebody who can't respond are just torture. So I completely agree there. But we have to look at the dynamic. You have to have some people have some pain, otherwise they're not going to change their behavior. So that's one point.

But the other thing is to really think about the way that our rate design gives people incentives to design smart houses to create entry by a number of different resale entities who will take the market risk of that volatility on themselves and pass average prices through to consumers which are better, all those things. So I completely agree that just tying people to a chair and giving them electric shocks is not really going to help change anything.

MS. WOLFMAN: Allen, go ahead.

MR. MOSHER: I'll agree with Dave Mead that in

tight market situations, a little bit of withholding goes a long way. And I think that is much of what we had, combined with bad market rules in California, that you could even be a relatively small supplier, but if you had a few percent of the market at that very tight market situation, I think you really could exercise market power through your bidding behavior, through economic or physical withholding.

Let me go to a summing up point. I identified a number of factors that I think need to be in place before I think that the market overall, the standard market design is going to work, and I wanted to come back to that. Again, we have to have generation and transmission adequacy, for example, to really expect the standard market design to work consistently over time and to minimize the amount of mitigation that we have to do. We want to avoid mitigation. We want to design structurally competitive markets.

And I'll repeat my point that we probably ought to be sort of predesigning mitigation measures and standard market designs that respond to the fact that some markets aren't going to have retail choice, aren't going to have divestiture anytime soon, are not going to have price responsive customer demand, even though we want it to be there. There are just a number of missing factors.

I'd also ask that we spend a little time on definitions of terms. We're throwing a whole bunch of new

terms that actually I'm -- David probably spends every day thinking about value of lost load, VOLL, but to be honest, not a lot of my brain has been occupied by trying to quantify that and figure out what the metrics are. So we've got a responsibility to define things like load pockets.

What exactly is a load pocket? What is the standard for it?

Is all of Wisconsin, which is certainly constrained on imports, is that a load pocket? Or is New York City alone or the Delmarva peninsula? Is that what defines a load pocket?

MR. O'NEILL: By the way, Allen, VOLL is somebody else telling you how much you value electricity.

(Laughter.)

MR. MOSHER: It does not sound like a good idea. At least not if you're a manager of a municipal system.

MS. WOLFMAN: I don't know if any of the other panelists want to respond on this point. As we get near the end of our time, I wanted to indicate we had one suggestion earlier that, you know, some of these are very difficult issues in a lot of considerations and don't lend themselves to this broad panel. One of those areas was price screens. And we had some discussion of that. And I want to offer the option to people after this conference to file technical papers, if you like, in this docket. We can put them on the Web site to have a discussion of what are the considerations

and what are the standards that should be used in that area, since it is a complicated discussion. And those can be filed in RM01-12. We can take them electronically and post them on our Web site under the market design section of the site.

MR. PATTON: Can I ask a clarifying question?

Are you talking about screens for market prices or are you talking about screens of bid prices?

MS. WOLFMAN: Bid screens.

MR. PATTON: Okay.

MS. WOLFMAN: We had some discussion of it, but there are a lot of considerations that go into it. We had some, you know, just to recap a bit, we had some discussion about the definition of market power, and I think we had some broad agreement on what it is, but some differences on when one should intervene.

We started to talk about standards and triggers, but not a lot of discussion about that. I don't think we'll get a lot more in this timeframe. We had some discussion of what's important to be in the structure of the market design, and we had some elements enumerated, and that was helpful. But we also recognize I think among the panelists it's difficult to differentiate between structure and rules. We haven't had a complete discussion of all the rules or what else might be necessary.

And perhaps we can touch in our remaining time on some suggestions that the panelists think of. If you can't get it all in the structure of the market design, what else do you need to make sure it is in place to mitigate market power? Don, you seem to want to go.

MR. GARBER: Yes. And we're getting toward the end. You've heard many things here today about elements of this problem. Some of these remedies are within your jurisdiction and some are not. I would urge you to, one, be permissive, to encourage all of the possible developments and improvements throughout the market that would make it function better. But ultimately, it's up to FERC to set just and reasonable wholesale rates.

You're going to have to defend, in the Court of Appeals, challenges to the results that come out of these markets, and I don't think it's going to be good enough to say, well, we did parts of it right, but the state let us down, or other elements of the market that we didn't have control over didn't function very well, like the demand side. I think you're going to have to have a complete answer to why the prices and the results that come out of these markets meet a standard that's been around for about 67 years, but very little has been said about how market-based results fit into the just and reasonable standard.

I think you're going to have to think through

that, and you're going to have to tell the world what your conclusions are about it, what you think is important to price formation, and how you judge the results, and the buck is going to stop with you. You're going to have to have a self-sufficient set of reasons why the prices meet that standard, and I wish you lots of luck because I think this is a major effort that has been underway now for the last ten years or so to use markets in lieu of the old vertically integrated, regulated approach, which I think needs to be replaced. I'm extremely supportive of the whole notion of using markets, but you still have the same legal standards you've always had.

MS. WOLFMAN: I gather Jade wanted to say something and then we'll come back over here.

MS. EATON: I just wanted to say that although I don't think we need to get into -- we need to be mindful of FERC's jurisdiction, but I have more confidence that actually there is case law out there that has allowed FERC in the past to take competition into account in its ratemaking and that it actually has only the problem that it gives us the same definitional quandary that we started with, because most of the case law says that a price that would obtain in a competitive market must perforce be just and reasonable. So we're back to where we started with your first question this morning. I don't see it as a problem of

legal authority but rather of definitions.

MS. WOLFMAN: Craig?

MR. ROACH: In terms of what else to do, three points. One is, again I've made this point before. But before you ever get the mitigation, the market monitor's primary function, and this is in the strawman paper too, should be early warning. We should be anticipating whether there are impending shortages, whether new entry is happening the way it should, whether progress is being made in other areas. So that's something else the market monitor and the Commission should be doing.

Second point though is on mitigation measures themselves. I would really encourage you not to be permissive. This is an area where uncertainty causes investment to slow or stop, and we're going to do more harm than good. To retain consumer confidence, we need say the three or some sort of the three measures that are in the strawman paper. Let's put them in. Let's make them perspective, and let's make that be it. Let's not say, well have these and whatever else you want. Let's not be permissive in that area.

Beyond that, I think Scott mentioned it, there are antitrust laws, and that applies to everyone. I hope someday we get in this business where we don't have the mitigation. We just are abiding by antitrust laws.

But I think it's important, you know, early warning, set the mitigation and that's it. Anything else the antitrust laws will catch, and obviously that's collusion, attempting to collude, attempting to monopolize or merging to monopolize. So that's it.

MR. O'NEILL: Do you exclude the unilateral exercise of market power from that list? Or is it just to hard to find, to discovery?

MR. ROACH: If it's considered it's in the middle part in mitigation. If you're asking me is unilateral market power against antitrust laws.

MR. O'NEILL: Well, I'm saying you said that you just wanted to let antitrust laws run.

MR. ROACH: Eventually, yes.

MR. O'NEILL: And so unilateral exercise of market power would be okay with you?

MR. ROACH: I don't -- well, again, let's talk about when we get to a competitive market. I would like only the antitrust laws to apply. We should have the same antitrust standard that applies to every industry. And yeah, I don't think typically the unilateral exercise of market power is against the antitrust laws.

MR. O'NEILL: And that would wait until Congress repealed the just and reasonable standard?

MR. ROACH: It would wait until we get to fully

competitive markets. I understand --

MR. O'NEILL: Let me put it another way. Should the unilateral exercise of market power violate the just and reasonable standard?

MR. ROACH: Today in a transition it is. And that's what these mitigations to some extent are after. But I'm talking about when we eventually get to the same standard every other industry lives under. But I understand for the interim for some period that we're going to get caught up to some extent with unilateral.

MS. WOLFMAN: Let me ask, are there any other panelists who would like to address the question of what else we should consider before we take a few questions from the audience? David?

MR. PATTON: We've talked some about the bid flexibility measures, like the offer cap that's triggered on conduct and impact thresholds. That's a mitigation measure that's designed to address economic withholding, and it's not designed to be punitive. And it's designed to be consistent with the operation of the market in fact to be invisible in its application.

But there are things that -- that addresses a segment of behavior. Your paper identifies two primary methods for exercising market power: physical withholding and economic withholding. And I think on the physical

withholding side it's necessarily the case that by and large you establish that after the fact. It would be great to address everything prospectively, but that's the sort of conduct that you detect through investigation.

And so in order to mitigate that, I think it's useful to have some measure that works as a deterrent against physical withholding. It doesn't have to necessarily be a measure that the RTO employs. It can be addressed through penalties that FERC employs through an enforcement-like action. I think in terms of designing mitigation that addresses the full array of conduct you're worried about. You have to think about how you're going to address physical withholding, because if you perfectly mitigate economic withholding, it's going to move people who have market power into the other categories.

If you have an appropriate deterrent, and I happen to agree fully with not undermining the market process after the fact by resetting market prices and so forth, but a penalty that's applied after the fact that's intended to serve as an adequate deterrent will prevent the behavior before it happens, and therefore it's prospective in some respects.

MS. WOLFMAN: Sonny?

MR. PROPOWSKY: I just wanted to briefly say in response to Craig's answer to Dick's question, I'm not sure

that that is the end state that we're looking at, that is a perfectly competitive electric market that is just like every other market. I don't know that you can get there from here. And because of the unique attributes of electricity, because of the obligation to serve and the other social and environmental reasons. So I'm not sure you can get there from here.

All I'm saying is that I think you still need market monitoring with the possibility of addressing the kind of issue that Dick raised, the unilateral exercise of market power that raises prices above just and reasonable levels. So I think we should design the market the best we possibly can and have you at FERC and people like at the RTOs do the monitoring to make sure we stay on course.

MS. WOLFMAN: I see there are people circulating with microphones, so we will take a question for the panelists from the audience over here and then over there.

MR. LIVELY: My name is Mark Lively. I am a consultant. I noticed that in the strawman paper it talks about a D.C. circuit holding that where a buyer has significant market power. Yet the panel has only talked about where the seller has significant market power. The buyer can have significant market power, for instance, where pipelines have penalties for people who leave too much gas on the system on the daily imbalances where electric

utilities have penalties for generators who leave -- who generate when they're not supposed to.

I'd like to hear the panel talk about where the buyer has market power and abuses that.

MS. WOLFMAN: Joe?

MR. BOWRING: As a practical matter, I would say that while we're obviously aware of the potential and we look for it and we've been urged to look for it by lots of those participating in the market, we haven't seen it to any significant degree. I mean certainly one potential area for that is in the area of DSM curtailable load. However, we look at that and we haven't seen any evidence of it.

I mean, it's certainly true that if you're trying to take a balanced view of the market as we are that you have to be aware of that. But as a practical matter, we haven't seen it.

MS. WOLFMAN: Allen, and then we can go to our next --

MR. MOSHER: The California ISO, many have alleged that it was designed to create buyer market power for the state of California. But it was predicated upon a surplus of generation within the region, and when that turned, it became exactly the opposite. It became seller market power. But other than that, I don't know of any major examples of buyer market power.

MS. WOLFMAN: All right, David, and then a question.

MR. PATTON: Just a quick point. Traditionally, buyer market power in an economics textbook has to do with buyers threatening to withhold their demand to drive prices down, and as Joe noted, that's extremely difficult in our spot market. There have been allegations that large buyers may withhold from forward markets or from the day ahead market in order to influence prices, and that is certainly something that needs to be monitored, given the size of some of the utilities.

But secondly, there are a number of actions that can depress prices that are every bit as damaging as actions to increase prices. For example, distribution companies often have the authority to take generation out of merit in their areas to protect their distribution facilities. If that's abused, it can prevent the shortage prices from emerging that need to emerge. We need to be balanced, and I agree wholeheartedly with the comment that what we're trying to get is the right price signal. Price signals that are inflated are damaging. Price signals that are depressed are every bit as inefficient.

MS. WOLFMAN: We have another question from the audience.

MR. TATUM: Thank you. My name is Ed Tatum. I'm

with Old Dominion Electric Cooperative, and over the past couple of days you might have come to know our organization as the load pocket poster child. So we're pleased to be here and appreciate the attention to that issue.

The question is in this conversation today, we talked about a close link between areas with wholesale and retail competition and possibility of dealing differently with areas that have no hope of retail choice in the near term versus others that do.

A question for the panel and for some of the economists on there is what if you have a situation where there has been, relatively speaking, a fairly liquid wholesale market and retail choice has been available in those areas but hasn't taken place? Is this indicative of a market power issue? Is it indicative of poor market design, a combination thereof? And what type of remedies would you suggest?

MS. WOLFMAN: Joe?

MR. BOWRING: Let me take a whack at it, and I'm sure other people will have an opinion. But certainly in PJM, which is in part I guess what we're talking about, Ed. Okay. I'll restrict my remarks to PJM and other folks can talk about the rest of the country.

But in any event, there are retail price gaps in place in most of PJM's territory. People pay fixed prices.

That does not mean, however, that there can't be demand responsiveness. It also doesn't mean that there's not a real price signal. And as people have pointed out here, there's a profit to be made. There's money to be made between if an LSC is buying high and selling at a capped rate, clearly there's money to be made from curtailability.

The LSC has an incentive to do it. Third parties have an incentive to step in and sell that service either to LSCs or actually primarily to the LSCs who are bearing the burden of it.

So I guess to focus directly on the question, ultimately there was a regulatory bargain made, and it had to do with payment of stranded costs in return for retail rate caps. So the question is, if you don't have a lot of marketers because for whatever reason, for example, the wholesale price does not permit an adequate margin when given the retail price cap is what you're looking for as a consumer, a low price or a lot of marketers. And I would suggest that the retail customers are getting the benefit of that regulatory bargain. And as long as that lasts, you're not going to have a lot of marketers. That doesn't mean that there's market power, that there's something wrong with the way the market's working.

MS. WOLFMAN: Do we have another?

MR. O'NEILL: Can I ask a question about the

price caps? Suppose we converted the price caps into cheap power entitlements which you could sell back to the market? Would that help?

MR. BOWRING: That's in effect what an intermediary can do. And when I said earlier that PJM is attempting to, and I think the right role for RTOs attempting to facilitate that market, that's exactly what we're trying to facilitate. Letting people see the value of not consuming and getting the value for it from the market.

MS. WOLFMAN: Yes, audience?

MR. WILSON: Seth Wilson with In Market. Really a question for Mr. Bowring and Mr. Patton. Joe mentioned he was blessed with a good market design when he stepped into the position. As a former director of compliance for the California Power Exchange, I was not.

(Laughter.)

MR. WILSON: I believe in Don Garber's comments and Scott Harvey that we've got to get the standard market right and I commend the Commission and Staff for working in those efforts.

In focusing on flexibility of monitoring and measurement as it relates to marginal cost calculations and unforeseen factors that drive and influence the market, particularly a variety of opportunity costs, be they locational, time differential or other markets, the question

I have are do you have protocols that actively promote demand responsiveness in your market design? Do you look at load pockets when you evaluate RMR contracts, grid connection policies that are established by the RTO in transmission expansion policies in committee meetings and reports?

Do you look or have you considered at benchmarking generation performance based on historical NERC data or internal RTO data? And then do you establish particular methods for monitoring gaming of structural rules that might be in your market?

And finally, have you considered or have you looked at establishing a disciplinary process that may be similar to what we see in the National Futures Association for commodity markets in establishing protocols and sanctions and penalties for activities, behavior in your markets?

MS. WOLFMAN: Those are a lot of questions. Can you boil it down to one overarching question or choose the one you want most?

MR. WILSON: Why don't we let Mr. Bowring and Mr. Patton just respond as they feel from what they received from that question. It may not be as comprehensive.

MR. PATTON: I unfortunately wasn't taking notes.

(Laughter.)

MR. PATTON: I'm going to work on my recollection. One thing you said, though, that I meant to try to make a point of at one point about the paper that FERC had issued on opportunity costs is that there is one design element that can address that issue of geographic opportunity costs, and that is having a design that separates the bid to import or export from the bid of the generating unit that's supporting the bid.

If you do that, then the generator bid doesn't need to reflect any opportunity costs associated with the neighboring market. The transaction bid will. And that's in fact what happens in New York and has been effective, because that can be a significant opportunity cost.

But as far as some of these other issues, I mean, we don't have RMR contracts. We deal with the load pocket issues largely through the bid flexibility or offer cap type mitigation.

As far as the benchmarking and other things, clearly we do a lot of that sort of analysis. As far as gaming goes, this is an issue I think that gets raised is how do you monitor for gaming, and is it different than monitoring for market power? I think in that regard, the comments that I had made earlier about focusing on withholding are key. Because what you're looking for is behavior in the market that doesn't appear economically

rational. And so that generally takes the form of withholding. And that withholding can happen because there's market power.

It's equally likely that it's happening in response to a flawed market rule that's providing a signal you don't want that supplier to be receiving. And before you jump to conclusions, you have to try to separate those two so that you can address flaws when they exist and not try to mask the symptom with mitigation.

MR. BOWRING: Let me try answering a couple. I guess the next to the last one had to do with benchmarking. We certainly do look at outage rates on a unit specific basis. We track that data. We have that data going back a long ways. And one way we monitor for physical withholding is to look at those outage rates. Obviously, they're a function of a number of facts. But if we see a significant change in outage rates compared to historical performance and there's not a good explanation for it, that's certainly a trigger for interest.

So, yes, we do benchmark. Similar to I guess Dave's response in New York, we deal with load pockets via our cost capping authority, one of the elements of the market design I described. That is, we have the authority in a load pocket, whether it be transient or longer term to cost cap units and to require them to run. And there are a

number of issues that raises, a number of complicated issues. We're addressing those. But to make a long story short, we don't have RMR contracts at all, certainly not the type that existed in California.

MS. WOLFMAN: One more question. Yes, in the back.

MR. TALLMAN: I'm Bob Tallman from LG&E Energy. This should be a short answer question. Yesterday the Generation Adequacy Panel discussed the value of capacity obligations in ensuring deliverability and encouraging investment. And this morning Mr. Bowring stated that it also had value in limiting the potential for physical withholding. And I'd like to know if the other members of this panel agree with that assessment of the value of capacity obligations in limiting potential for physical withholding.

MR. ROACH: I certainly agree that having a capacity requirement has value. I'm not sure I'll trace it to limiting and withholding. But I think that it really does have value in terms of helping with reliability, helping to, in a legitimate way, manage volatility. And most importantly, in being a way to legitimately assure that there's adequate investment in the market.

So I think it's an element of standard market design that really has several good benefits.

MS. WOLFMAN: Why don't we just go down -- Scott?

MR. HARVEY: Well, I'll do time in purgatory for having been involved in ICAP markets, but they aren't going to solve the problem. They're going to make things more complicated. And if I have market power in the energy market, I also have it in the ICAP market, and I'll be able to use it.

So, you know, you've got to deal with the market power problem. You can't get around it. You either have to have divestiture or financial contract, some kind of mitigation, because one way or another, if I've got it, I'll use it. And it's even harder probably to deal with it in the ICAP market, because how in the world do you decide what the reasonable offer forward in the ICAP market is?

MS. WOLFMAN: Allen and then David.

MR. MOSHER: My measure of choice for market power mitigation in the long-term market is to allow load to contract forward and ensure the deliverability of resources. When they're surplus, they get released to the market and they're dispatched within the ISO. We can talk about whether it's market-based, bid-based or whether it's based on cost. But that's my preferred model for mitigation. That and also allowing bilateral contracting so you always give load-serving entities an alternative to buying through an RTO market, at least to the maximum extent possible.

MS. EATON: I have a question instead. And I'm looking forward to being able to read the transcripts or whatever is available from yesterday's generation panel. But here's my question. It seems to me that when you try to get something to do too many jobs, you're not going to get it to do any one of them very well, and that that may be a problem with capacity charges of various kinds.

The one that I can see clearly is valid and necessary here is that part of the reserve market that preserves reliability. And by that I mean electrical reliability. That if a unit goes down, there has to be a way to pull electricity back onto the system so the system doesn't collapse. That that is a system cost. It has to do with the ability to deliver power. And that might dictate a different kind of structure and who pays it.

Everyone else is talking about a lot of other things. Many of them have to do with the problems of volatility, a check on withholding and some other things which really don't have to do with system reliability, they have to do with whether you trust your supplier. And that gets to be maybe we need some checks on that. But traditionally, markets took care of that. Markets didn't take care of this problem of the wires burning down.

So I just put it out that people should maybe be thinking very carefully about what problem they're trying to

solve with everything they're calling capacity markets.

MS. WOLFMAN: Joe, did you want to?

MR. BOWRING: Yes. Just to be clear, we're not going to have the whole capacity market debate here, because we only have 60 seconds left. And I can do it in 90 seconds, but 60 seconds is just too short.

(Laughter.)

MR. BOWRING: In any event, I wasn't trying to assert that the ICAP market is the critical market power mitigation measure. I was simply pointing out that the ICAP market, in addition to what I regard as its other benefits, also has a market power mitigation component, to wit, their requirements to offer in the day ahead market, and there is an incentive not to physically withhold that. That's a real incentive. It's perhaps not the central mitigation feature of the market. Thanks.

MS. WOLFMAN: Thank you, panelists. This has been very helpful. An excellent panel, and you've brought a lot of different perspectives to it. And it's been very helpful.

Since we ran a little bit over, why don't we start this afternoon's panel at 1:40.

(Whereupon, at 12:40 p.m. on Thursday, February 7, 2002, the meeting recessed, to reconvene at 1:40 p.m. the same day.)

AFTERNOON SESSION

(1:45 p.m.)

MS. FERNANDEZ: Could people start getting to their seats so we can get started momentarily? I'd like to welcome you to our last session of the week. The afternoon session is on minimizing the cost of implementing standard market design. Dick O'Neill is going to start off with some opening comments on this panel.

MR. O'NEILL: Most people didn't know that the last two-and-a-half days were simply a set-up for this panel. Twenty years ago I left a position as professor of computer science. And so this in a sense is a homecoming.

And in some sense, this was a set-up, because over the last several days, we heard stories about why you couldn't do this and why you couldn't do that, and oftentimes the stories were, we couldn't do that because there was a software problem or because it cost too much. For example, we were talking about demand-side management, and somebody said there wasn't enough buses in the New York model to do demand-side bidding. Somebody said in a casual conversation that if we did that it would take a half a billion dollars in software development costs, which is probably a couple of more zeroes than I've ever heard talked about before.

And there are issues that we used to hide in the

roundoff in the old vertical system, a million dollars here, a million dollars there, that Sue Kelly told us the other day that were very important to her when she gets a bill from PJM for congestion costs. Although in the PJM scheme of themes, they maybe roundoff numbers.

(Laughter.)

MR. O'NEILL: So what we have discovered is a lot of the issues that we used to hide in the vertical structure and the software problems are now sort of coming out and confronting us. Another example is in the security constrained unit commitment, a standard model is a Lagrangian relaxation that gets you an approximate answer. And for the vertical company, the approximate answer was pretty close. But if you were the approximate answer that didn't get dispatched and you should have been, you have reason to be concerned and you have reason to complain to us.

So what we're going to do today is hear from a group of people who actually write the software and a group of people who actually use the software -- they purchase it. And a group of people that test the software. And what we want to do is going forward to make sure that we design the market and the software in ways that are not going to be so expensive to essentially put a drag on the market design.

I hope that we will be able to start a

relationship here that's very productive and leads to a new generation of software that is modular, testable and transparent to say the least.

With that, I'll shut up and turn it back to Alice.

MS. FERNANDEZ: Okay. I get to be I guess the moderator for the rest of this. I think we're going to follow the same basic format that we've used for the other panels, which is that basically we'll start off and give everyone a chance to make a brief opening remark, and then we'll get into some questioning. And then we'll try and take a break at around 3:00, 3:30. So why don't we start on the left with Mr. Sun, and then with the other from ESCA. And if the other people could introduce themselves when they're starting with their presentations.

MR. SUN: Good afternoon. I'm David Sun from ESCA. First of all, I'd like to thank the Commission for giving us the opportunity to participate in this panel session. As we know, this could be a set-up, but we enjoy the challenge.

Software issues are the topic of this panel session. And to a large extent, when people talk about issues, they think of problems. Indeed, there are many problems. To a large extent, the definition or understanding of issues to include not just the problems but

also where people have succeeded. It's only by looking at both success factors and failure or mistake causes that we can move forward better. So with that, I would like to see us looking today at leveraging our experiences from the past and look forward to the future how to implement SMDs in a more successful fashion.

And as an example of some of the news items, failures often get on the front page, but successes don't get as much visibility. An example is back in '96 when we first implemented the New Zealand system, nodal pricing co-authorization was a fourth-month activity. So some things could go right. We want to exploit that possibility.

The SMD process we're very, very happy to see it's in fact in our mind, it's a very natural step in the evolution towards competitive electricity markets. It is this process that with SMD initiative -- I'm using that term -- we are seeing a business driver being formed that will allow better streamlined software implementation processes. With a set of more standardized requirements, it is possible to look at software qualitzation. It is possible to look at upgrading. It is possible to look at a framework whereby with the same set of -- with a modular structure, the best of three solutions could be integrated in a vendor neutral platform, and that is something we believe strongly in.

Now many projects today in the ISOs and RTOs do

have multiple vendors present at the same site, and I won't elaborate. But at every one of the sites, we will see that. However, that process has been somewhat ad hoc, and I think we can do a better job taking a more standardized, more systematic approach towards the SMD-centric process. It is along that line I, representing us at ESCA will volunteer, we at ESCA will volunteer to lead an organization or ad hoc organization to have different stakeholders focus on moving the SMD implementation process with greater coordination, and we can offer this goes into more discussion later. We'll be happy to describe how we see this may be implemented.

With that, I welcome discussions later. Thank you.

MR. CHEN: My name is Yilang Chen. I work for ABB. It's a global automation and a power technology company with 160,000 employees and represents in more than 100 countries. I'm speaking here today from the perspective of a market operating system developer and as an industry automation infrastructure provider and also asset management.

ABB, working with our customers, has accumulated considerable experience in the development and the implementation of a market operating systems. Our product portfolio enables our customer to integrate industrial

systems by managing information based on open industrial standards.

I want to thank you for the opportunity to be here today. It's indeed a very timely panel. Over the last few years in the process to restructure the industry, the IT issue was often an afterthought. As an industry, we underestimated the complexity of the required IT systems, and we were surprised by the fact that implementation details had material impacts to overall market performance.

We believe that FERC is doing the right thing by considering the IT implementations issue up front in this overall market design effort.

I'm here today to discuss the cost of IT issues and specifically to tell you that the cost of IT systems is not disproportionately high relative to the benefit. A market operating system represents a large investment. The cost consideration is rightfully so on everyone's mind. If the cost of our IT system is more expensive compared to other major IT systems in other industries, the answer is no. One can validate the total cost using different methods.

More important than the cost minimization is the ability of the IT system to support a healthy market. A less optimal IT decision costs RTOs millions. However, a poorly functioning market costs the consumer billions. On

the other hand, everybody gains with a properly implemented IT system.

Open architecture standards and the use of best practices do reduce costs and assert quality. They would allow the IT system to be more responsive to the changing business needs. What we can expect is an improved cost benefit ratio instead of a reduction of the overall cost.

Many issues have surfaced over the last few years. The most important lesson we learned is to strive for a global optimization and not to look at individual problems independently. This principle should apply to the way we address software issues, and cost is one of those issues, and it should not be addressed in isolation.

Implementing a new market design is a long and iterative process. ABB looks forward to supporting FERC and the industry. Thank you.

MR. ALSAC: Good afternoon. Thank you for inviting us to this panel. My name is Ogun Alsac. I am the director of the power computer applications software group of Nexant. We are located in Mesa, Arizona. Since 1984 we specialized in high end power system software development. By this I mean we do not provide software systems but we provide components, engines that can be used with various software systems.

We have things like state estimation, contingency

fault analysis, congestion management, LMP calculations and other FTR, TCC calculations. At least a hundred control centers all around the world have implemented our software through different software system vendors, and approximately another 50 utilities use this software, including California ISO, Maine, National Grid Company, New York, and PJM.

My comments in this panel are based on our experience over the years as a third party independent software supplier to many vendors and integrators in this field.

To start the discussions, I have two general comments related with the state of the software for market applications. My first comment is related with the loose coordination between market designers and the software developers. So far in many cases, the market design has been an independent activity, defining nonstandard, different market applications, followed by quick response RFPs asking for short-term delivery schedules.

Inevitably, this resulted in developers promising new and complex market software which cannot easily be developed within schedules, delays and costly development efforts, producing unsatisfactory implementations which cannot be fully tested and further developed and basically in everyone cutting corners.

Another comment is related to the poor

understanding of the data requirements and modeling issues in market software. Data necessary for these applications to run satisfactorily have often been poor quality with insufficient redundancy. Models used and their reduced derivatives are quite unsatisfactory. Data exchanges between components and ISOs and RTOs often not timely or not format and content compatible, which resulted in network models derived by state estimators and used by all subsequent calculations are often poor representations.

These issues are very similar to the issues in the early days of energy management systems. And also at that time, this was about like maybe 20, 30 years ago, when new control centers for utilities were coming up and there were exactly similar issues in those cases, and also at the time the industry responded and tried to solve some of these problems.

A great deal of effort at the time was spent in defining standard applications and this paid off quite well. Today a lot of EMS's use very similar Bayes applications. The critical work of standardization of the data and modeling came later, with limited success. Open software architecture won over software standardization, which allows plug-in software applications of specialized third-party vendors when and where necessary.

Examining the current situation under this light,

I believe market implementation issues will result in a similar manner as we progress through this panel and in the short-term. Thank you.

MR. IRISARRI: Good afternoon. My name is Guillermo Irisarri. I represent Open Access Technology International. Over the past six years at OATI, we have been involved in the development, implementation, operation and maintenance of large scale applications to serve the electric utility industry. In particular and of great pertinence to the current discussions here, we are the developers and operators of the so-called NERC interchange distribution calculator.

The NERC interchange distribution calculator or IDC is perhaps the largest real time online application currently in operation in North America. It covers the Eastern interconnection from the Rocky Mountains to the Eastern United States and from Northern Canada down to Florida. The size of this system and its criticality reflects the needs that we are seeing already in the upcoming super RTO sizes that are being planned for the future.

This system addresses the needs of systems of many thousands of buses, on the order of 35,000 buses, which is the Eastern Interconnection model; 45 to 50 thousand branches, and thousands of flowgates and other branches and

equipment in the power system. It also works in a symbiotic fashion with the e-tagging system that you may be aware of in which every single transaction in the United States and North America in general is received by these IDC, and the IDC is used as a congestion management tool currently by the security coordinators of the Eastern Interconnection.

Now I bring this system as an example of a software system not necessarily as an example of a congestion management system. That's a subject for a different discussion. But as a software system, it is very pertinent to our current discussions here today and into the future. Given first of all its very large size, its needs on modeling issues and the specific types of decisions and approximations that are necessary to be able to provide robust, continuous results to all market participants, whether it is an RTO or whether it is the whole Eastern Interconnection of the United States.

Our experience with very large scale systems also applies to two RTOs at the moment, in particular the Midwest ISO. At OATI we are the providers of the current Day One Congestion Management System, which involves many of the components of the future standard market designs as proposed.

And the next one, which is a smaller sized system but also equally challenging, is the Grid South System. We

are also the providers of the Day One Congestion Management System.

We have developed, in addition to these systems, a market design to respond to the needs of the super RTO sizes. In particular we have in mind the Midwest ISO, together with neighboring systems such as Southwest Power Pool and PJM, which will require very critical, large infrastructure for its utilization and successful usage.

So I am very happy to be here this afternoon to discuss these experiences and to explain and discuss as well the software development process that we use at OATI together with our partners in the development of these applications. Thank you.

MR. VAN WELIE: Good afternoon. My name is Gordon van Welie. I'm with the ISO in New England. I've got a presentation which I've handed out to everyone. I've had the pleasure and the privilege of working on both sides of the customer and vendor fence, and I've entitled my presentation this afternoon RTO Software Standards. And what I'm hoping to do here is just share one person's vision on how we might go forward and avail ourselves of what I think is a very unique opportunity. As the FERC sets out to standardize market design and set up the RTOs, I think we can do some things in terms of using that momentum to drive standardization within a very critical aspect of this

industry.

On page 2, I just briefly cover the topics that I intend to cover during the presentation, some brief words on why do we need standardization? What do we need to standardize? The evolution of market design and software design. I think these are very interdependent topics and need to be managed as such. I give some thoughts on RTO software architecture, CIM and application bus, security, modularity, testing and validation.

So with that, let me move to page 3, which is why do we need standardization? I think it answers the primary question that the Commission has put to us, which is how do we lower the costs? It will drive costs, and it will also drive risks down. It will ensure multi-vendor interoperability. I think it's essential to making the standard market design concept work on a broad scale, and I think it will help the industry to mature and stabilize. As one of the previous speakers said, the EMS industry is pretty much mature at this point. In the area of markets, we are now just starting to see the industry mature, and I think we can help that process along.

Page 4, I cover some standardization principles. So in thinking about standardization, you've got to have some framework which guides how we move forward. I think we need to ensure compatibility and communication between

software components and applications from different vendors.

We obviously need to be able to validate the software compliance with the market design and the rules.

I think, however, we can't be too slavish about standardization. We can't drive it down to the last nut and bolt. We've got to allow for continued innovation and vendor differentiation. And so therefore you can't overcontrol that process. And so therefore, my proposition is that you don't try and standardize the technologies used, you don't even try and standardize the algorithms used, because people will come up with better algorithms next year. But you need to ensure that the black boxes talk.

The next page is just a picture meant to tell a story of how this might move forward. As I said, I think we've got a unique opportunity. Standard market design, which we're implementing in New England based on the PJM market design rules, I've just termed that SMD 1.0 as a starting point. We've tried hard to employ a modular architecture, and I think this is the first step towards standardization of market design and rules, because you have two ISOs in the country starting to move forward on the same basis.

But it's obviously not enough going forward. And I see that two things happen. The market design obviously will have to evolve and will have to incorporate other best

practices from around the country, but the software design and the software architectures that support that need to evolve in parallel. So I've laid out there under SMD 2.0, whatever label we give it, you'll see there CIM compliant. API and Market CIM Extension design. Trading standards. Security framework. Market rule validation. Multi-vendor support. I'll explain some more of those terms a little bit later in the presentation.

And then as you go further out, an application bus standard supported by multiple vendors, security standards, and metadata interchange.

I'll also mention later on that standardization is a slow process. It doesn't happen overnight. And the reason for that is that they are competing technologies, competing ideas, competing vendors. And so there normally needs to be something pushing this along in order to make that happen swiftly. If you just let it be, it can take a very long time to create a standard. If you speak to people in the IEEE or in the IEC, the international version I guess of the IEEE, they'll tell you that certain standards took ten years to be created. And sometimes by the time the standard is created, it's not really relevant anymore. So I think that's something that we need to be conscious of.

The next page, which is page 6 in the presentation is what do we need to standardize? And I

called it making the black boxes talk. One of the previous speakers said that market design and rules are very closely linked and have a direct impact on software architecture and implementation. That's true. It's one of the reasons why we made the change within New England to simplify our implementation of new markets.

In terms of a high level architecture, I think one of the important things is to make sure that there's modularity in one's approach to implementation so that when you change something in one part of your system, you don't have to basically follow the trail all the way back through every application that you've ever designed.

I've got some guiding principles in parenthesis. Obviously standardized market design and rules is a must. I think we need to have a standard view on the application framework and the basic building blocks, and very importantly, the principles of operation between these building blocks. I think that you can allow for regional differences in the details as long as they do not result in rules or software that inhibits the flow of transactions between RTOs, which is in the end the superordinate goal of seamless markets.

There's a standard out there called the CIM, the Common Information Model, which has been around for a while. I think it's a very good idea. It hasn't got as much

momentum as it probably could have. It focuses on standardizing the data model. And I think this is a good basis. Just like the PJM market design is a good basis for moving forward with standardizing the market design, the CIM is a good basis for taking something that already exists and extending it for what we need in the area of markets and trading.

The other thing I think we need to take a serious look at, which has also been talked about for a long time within the industry, although no specific standard has emerged that I'm aware of, is an application bus. There are a number of different competing technologies and proposals in this area. But this would allow a standard protocol for communication between applications.

I also mention a security framework. I saw a report just recently which said that entities in the energy or the electricity utility industry are far more prone these days to cyber attack. So I think one of the things we really need to look at is what is our overall approach to this? How do we standardize and ensure that we are building robust systems?

And then obviously in the area of participant interaction -- data input, publish and reporting -- the more we can standardize the look and feel and the way we interact with these systems, I think the less costly it will be in

the long run.

Page 7 is just a very high level diagram that tries to depict what I've just said in words. You see the Application Integration Bus. You see various applications connected to them. I've roughly categorized them into EMS applications which are associated with control of the power system, and then markets software, particularly those that are doing the calculation of pricing and doing the optimization of the market.

And then you see the CIM data model connected. And really what you want is a fairly clean architecture going forward which will allow you in the end, if these things really are standard in the way they communicate with each other, to use those boxes from different vendors. And then I think what that does, it allows competition to be introduced within the industry. It gives the customer I think a greater degree of certainty that they can pick the best application from the best vendors.

On page 8, I very briefly cover the Common Information Model. It's an industry accepted standard for control center EMS data exchange. It's been developed and tested among major EMS vendors as part of the EPRI-led CCAPI project. It allows for network model exchange. It supports advanced network applications, energy scheduling and energy accounting functions. It enables multi-vendor integration.

They've actually gone a fair way down the track in terms of setting things up in a way that different vendor products can work with each other.

Our belief is that it requires the design and implementation of what we're calling market extension to be able to handle market clearing applications and trading. So at the moment, it's very EMS-centric and needs to be extended if it's going to be of use in terms of standardizing in the markets arena.

Application bus. There's a technology called Enterprise Application Integration technology, which is -- and I'm not an IT wizard, so don't ask me what metadata is. I have some high level idea. It's really data about data. It allows communication between these applications.

But by standardizing the way you interact between these various applications, we believe that you will significantly increase the effectiveness of application integration, and you reduce build time for putting these systems together. It's an industry accepted technology. It's been implemented by several major power industry vendors. It's part of the CCAPI standardization effort and once again has to be extended to handle market side applications.

Page 10, security. It's our belief that we need to establish a common security framework. I think it's

going to be too ambitious to try and standardize everything down to the last nut and bolt here. Here are some examples: Digital certificates. Authentication servers. Authorization servers, and profile based security. Encryption obviously something that needs to be there. And of course the whole issue of redundancy and back-up capability is something that needs to be part of any good software architecture.

Page 11, modularity. One of the key ways to maintain flexibility going forward because obviously the markets and the systems will not be static. So one of the key ways of maintaining flexibility is to take advantage of component-based system design, which is the way most vendors are doing it today. So this is no great leap for vendors, but it really ought to be part of the specification if you are looking for what is our vision going forward.

This will allow easy repartitioning between different levels. It allows you to move around your application, depending on the configuration of your organization or your market in the end.

Needs to be able to support distributed computing. Obviously scalability is an issue which needs to be taken into account in any software architecture. And one of the things that I've seen work pretty well is where the market rules are supported on the basis of some form of

rule-based software design and construction rather than hard coded. And I think that gives a great deal of flexibility going forward, and there are plenty examples out there in the industry today of where that has been fairly successful.

Page 12, testing and validation I think is a very important thing from a customer perspective, from an ISO and RTO point of view. I see a number of different levels here, though, in terms of testing and validation.

At the level of making sure that the black boxes talk to each other, I see that we could certainly use some central standards authority for validating that the software is CIM compliant and is application integration bus compliant. And I think EPRI is a very good choice in this area. It doesn't have to be EPRI, but they have been pretty much a leader in supporting this kind of development.

The other level of testing and validation comes at the level of functionality, in terms of making sure that the software does what it was originally specified to do and is compliant with the market rules. And here I think the onus is on each RTO to conduct regular internal and external audits to ensure that the output of the software complies with the market rules.

If we get to the point of having one national market design and rules, then you could probably turn that over to some central standards authority to do that for the

RTOs. So that I think is not something that I would prescribe. I'm just saying it's a possibility.

And then obviously each RTO would have to meet software security standards.

On the last page in conclusion, then, what I'd say is don't be too ambitious on scope. Standardization is a very difficult thing to do. There will be lots of opposing pressures. I think it's very important to have a clear vision as to where we are headed. I believe that a neutral body should be the keeper of the standards, and I believe that should not be a vendor or an ISO or an RTO. So there needs to be some neutrality in how this is managed.

I would focus on standardizing the data model and the data interchange first. I'd say that security standards are a requirement. And I've said this earlier on: Standardization is a slow process. We need to get started now, and we need to find a way of funding this within the industry. Thank you.

MR. OTT: Good afternoon. My name is Andy Ott. I work at PJM, responsibility for market development and I'm the customer of the software vendors, so I'm on the customer side also.

In looking at the questions for this panel, essentially what we're saying is we want to minimize costs going forward and we want to have compatibility. We want to

essentially have scalability and be able to evolve into the future. And I think the customers also want something. And what they want is standardized data input formats.

So I think if you think about those issues, what that's saying is we do need to develop I think first and foremost the idea of standard data interfaces, standard data exchange protocols between these systems. I think that gets you a lot of, in addition to standardizing the market software design -- excuse me, the market design itself, standardizing the data interfaces I think takes you a long way towards making the customers happy where they see one interface and they don't have to train their people on ten different interfaces if they trade nationally or a few interfaces if they trade locally.

I think the other benefits you get there is once you put those standard protocols in place, then the idea of transparency of systems. The way we've acquired software in PJM is we tend to buy software modules, software engines, and we act as the system integrator. What that allows you to do is if you drop in, if you have standard data protocols, you can drop in these other engines. And we've actually used that to audit in PJM. We'll run one, the production software, and then use another engine to audit it more or less to produce the same result. There's a lot of ways to audit something, but that's one way. And this kind

of thing would enable that.

I think just knowing that that kind of stuff happens behind the scenes gives participants confidence that the software is tested.

The other big issue is in giving the participants the data. In other words, we've had a general lack of the ability. In PJM we have the breaker node formats, which is similar to the CIM model that Gordon had talked about, and we have to convert that to a power flow, another type of format that is a standard, whether it's PTI or IEEE or something like that, in order to give it to the participants, because there is no real standard protocol that we can give that data out that is at what I call production grade, meaning commercially viable, if you will.

So the point is, is there's something lost in that translation. So I think from the customer end, I have a lot of customers who actually simulate our results. I tell the story that when we went into nodal pricing, the first or second day we went in, I got a call from a customer who said, you know, I think that price should be, you know, 33.2 and it's 30 point something, because they were actually running, taking the best data system they had available and running their own. And that's gotten much more sophisticated.

So I think having standard protocols gets you a

lot of the other things that you've listed.

I think one other area, cost minimization. I think we as an industry have to realize market systems are not EMSes. And I think obviously the EMSes are great systems. They've been around for a while. They have a lot of great functionality. But when you put a market system in, it's functionally different than an EMS. An EMS is built, it's a reliability type system. It's built to model the power system in near term. When you switch over to market systems, it's a different animal. You're looking at forward hedging. You're looking at a model of the system that's trying to essentially ensure that you have a financial model that's physically feasible, meaning that it will match up when you get into the physical delivery timeframe, which is the real time market.

So when the concept of, for instance, a forward financial transmission right model. You have trading hubs, and you put in virtual bidding points and you have these other things. That doesn't lend itself to AC voltage analysis, because a virtual generator doesn't put out virtual reactive power. You have to make an assumption about what it puts out.

So when you're acquiring the software, you have to avoid the trap or avoid the desire to just take the off-the-shelf system. You want to actually tailor it to what

you're looking for. That may in fact lower the expense in our case. The assumptions that you put into a DC model are no worse in accuracy than the assumptions you have to put into an AC model when you have to assume what reactive power a virtual generator would output. It's the same type of assumption. So I don't see there's a huge gain in accuracy. But it's a lot more expensive to develop the AC model. But if you don't get the accuracy you need or you don't get an accuracy gain, you may not see a huge benefit.

So I think there are some areas where you have to look at what you're trying to accomplish. That's probably all I have.

MR. SOBAJIC: I am Dejan Sobajic with EPRI, responsible for a group on the degree of reliability in power markets. I would like to thank the Commission for giving us the opportunity to address this panel.

Let me start with -- actually I had a handout. I didn't have enough copies, probably only ten.

MS. FERNANDEZ: Everyone I think on this side has one.

MR. SOBAJIC: All right. Thank you.

MS. FERNANDEZ: And actually, if you have the disk, if you'd give it to us, we can put it up on the Web.

MR. SOBAJIC: Sure. That's what I was planning to do. Thank you. I think I will echo some comments made

by previous speakers, but let me start with a statement that I believe is shared by many others, you know, especially those who attended previous two days, as Dick said earlier, setting the stage for these discussions.

I believe we all agree that markets are really, really complex systems. And it is not surprising to us to look and see the situation in which we are today, trying to understand how markets function, what are the features that we should be looking at? What to measure? How to develop all these component systems? These discussions really resemble discussions that we have seen in the late '50s, early '60s.

As some of the previous speakers alluded to the development of EMS. If you go back that many years you will see that in the world of system operation, there was quite a good bit of understanding what are the components of that, how to look upon the power flows, the notion of the overloads, the voltage problems and all that. But what was missing was the framework that is supposed to put all these things together. The framework that is going to sort of give a big picture and explain the big picture.

And that thing happened in about '65, '66. There were a couple of really groundbreaking papers that were published, and then the whole thing started unraveling. EMS vendors came up. They started putting the pieces of

software together. They knew exactly what are those boxes to put one after the other, and that's how the things took off.

So what I would like to propose to you is that our understanding of market systems as a system is really at the very rudimentary level. We are still looking for this type of a big picture that is going to put all the pieces together: When we talk about the market power, when we talk about the clearing prices, when we talk about day ahead markets or real time markets. These things are kind of unrelated if you read all the literature that exists today.

So that's one fact. You know, the other one is, of course, life is going on. We are in the market-oriented environment. And we have to see how to deal with the situation as best as we can. Talking about standardization, I think we have two options there. One is to look in the process. One is to look in the interfaces between those process or both. I think the past has indicated that looking in the processes is perhaps not that smart because, as it was said before, you know, there is always somebody who is going to come up and outsmart everybody before him and come with a faster algorithm, different thought. It will develop better and better things.

On the interface side, the things really make sense. All the fuzziness that we see in the marketplace, we

are seeing some potential ways to move forward by working on the standardization of the interfaces between the market elements and also relationship between market and the system operations and the other modules.

And as a consequence of course of this type of standardization, we are coming to the modular design. I think we all said that. One important thing about the modularity and the flexibility is that we should be aware of the fact that the changes that are happening in industry are to some effect nonreversible. Some of the things that deregulation is doing cannot be traced back, even if we would like to. And we have to think about that when we are working on this design side to make design as flexible as possible so that we can realign so to say the boxes in the way that will be optimal perhaps under some different arrangement that may emerge, you know, seven years from now.

And in closing I would like to say that EPRI has worked on the standardization side. We have led the industry in developing common information model and API, which is Application Programming Interface standardization process. Not all of them are completed. Some communication protocols on the standards have been completed so far, like so called ICCP and UCA and all sorts of acronyms there. And we believe that this experience and expertise can be directly applied to address the industry need in developing

the standards for the competitive markets. Thank you.

MR. PALIZA: I'm Roberto Paliza with the Midwest ISO. I thank you for the opportunity to be here. I just have a few comments in my opening statement. Implementation of the standard market design in the Midwest will pose unique challenges to the MISO and the software vendors because of the scope, complexity and the scale of this project.

Establishment of markets in the Midwest as proposed by the MISO congestion management working group is a significant shift from the way the Midwest systems are currently operated. And therefore, it requires a careful evaluation of alternatives to minimize raised cost of a project and ensure a smooth transition for customers while achieving the ultimate goal in a timely manner.

We need to keep in mind that to implement the proposed MISO design, other key system elements need to be fully operational. One of such elements is our state estimation solution over that very large transmission network, which in the case of the Midwest, including SPP, MISO and Alliance companies, is over 30,000 matches. This has not been done before in a real time environment and may lead to development of new software/hardware architectures and new algorithms.

An important consideration when evaluating

alternatives to implement the ISO market design is the price of these new systems. In our experience, the price of EMS systems and the like are dependent on several factors. For example, price increases if the project requires new development or if it is an existing product, price is dependent on the degree of customization.

Another important factor is the duration of the project. The price increases as the timeline for the project is shortened.

Another factor is the risk associated with the project which translates to the type and amount, including the contract, if the system is not delivered on time. A key factor impacting the price of these of these systems is the degree of competition. If there are several credible and viable vendors, the prices will be more competitive.

Standardizing the market design of relevant components included in it will go a long way in helping to develop open software specifications, and by doing so, facilitating the development and implementation of software components by various vendors which ultimately should result in competitive pricing for these systems.

Conducting interoperability tests among vendors of critical elements of the standard market design similar to those tests performed with ICC, CMXML and tagging will ensure that the software design is modular and that these

elements can be integrated into a multi-architectural system.

As my closing remark, I would like to emphasize that software should not drive policy. It is the other way around. Software is developed to implement policy, and the best way to ensure that the software required to implement the standard market design is timely developed is to have well established requirements for the system, which I believe is what the Commission is trying to address. Thank you.

MR. DOGGETT: Good afternoon. I'm Trip Doggett with ERCOT. Thank you for inviting me.

I've been involved in the implementation of the ERCOT operating system for about the past year and a half, and obviously, representing the users' perspective, I do feel that software is a critical element in the standard market design, and standardization of that software should be a goal.

I took a look at the list of issues that you had prepared. I agree with you that as you consider the characteristics of standard software, you should look at transparency, testability and modularity. Two of these that I wanted to comment on today would be transparency and modularity.

Transparency to me is an essential characteristic of the standard software. In my opinion, it's unacceptable for market participants to look at our software as a black box. They really should be able to understand our software, be able to develop shadow settlement systems, trust us, and develop similar results in their shadow settlement systems. If you don't address transparency, what you end up with is a large dispute resolution team and a large legal staff dealing with disputes.

Another issue related to transparency that you might want to consider is the posting of data and the use of

data warehouses to make data available to the market participants. They really need this data to hedge their risks and develop shadow settlement systems. It also helps create a level playing field by making that data available to some of the smaller participants.

Modularity, or multi-vendor integration, I think has been mentioned by everyone on the panel so far. I think that's a real key. Kind of echoing some of Andy's comments, I would say that that's real important from a market operator's standpoint as well as a market participant's standpoint.

I guess I'd use as an example if, as a market operator, you make a change to your EMS system, and because of a lack of modularity that requires a change in your settlement system, that's going to create problems for you and it's going to create problems for your market participants in adopting those changes in their software.

I guess I would close by saying that we should focus on the development of interfaces that allow us, because our markets are evolving, to enable multi-vendor interaction and integration. I think that's something that we need to increase the level of competition at the subcomponent level of our systems.

Thank you.

MR. O'NEILL: I think I heard agreement, but let

me just check.

Could we start working on a standard data definition, which I believe is the CIM? I guess that's the candidate. The question is, can we agree -- or how long would it take us to agree on a data definition to get this process working?

MR. OTT: I'll start by saying CIM is the network model, the technical model. You need to develop a market side to that, as Gordon had said.

I think the CIM -- what are we on, Version 10 or something -- and I think at some point, CIM will stop. It will be usable, and I think we need a market side to that.

I think at this point that's probably a good starting point. I don't know how long it will take, though. I guess I will defer to the technical.

MR. IRISARRI: I would like to in some way echo the statements of Andy Ott. The CIM -- and Gordon said earlier the CIM has been designed to address the needs of the EMS. As mentioned earlier, the EMS and the market systems are different. They are different in many ways. The EMSes are addressing the real time concerns of relatively small electric utility systems, compared in size with the needs of the RTOs that we are seeing proposed.

The data needed to support the market systems is quite different than the data currently modeled in the CIM.

A great deal of the information needed to execute the market system needs, such as forward market FTR auctions, for example, does not exist whatsoever in that model. It's not addressed at all.

The real time models used in the CIM -- node breaker-type models -- are not applicable for the long term, as mentioned earlier. So even though the spirit of the CIM makes sense as a common information model, the actual details of its current implementation, I don't see them being applicable to the needs of the future markets.

MR. SUN: I'll echo that point, although maybe from a slightly different angle. There are two issues. One is, as Gordon mentioned, standards do not happen overnight, so be realistic about how long it will take to come up with that. For CIM today, we're looking at five to ten years already, and look where we are. There's no question we need to move forward on that. But be realistic on expecting the time frame.

The other one is, CIM is primarily servicing market operators. I feel the better return may be on serving market participants, people such as for us -- the multi-regional participants such as Dynegy, for example, need to play in different markets. We've got to standardize that front, and that will be much more easily accomplished than that of how do you model a circuit breaker or an SVC.

There are certain things that I think return faster. We should focus on those areas, and that's where CIM can really contribute.

MR. O'NEILL: Do we start with CIM and build out, or do we tear CIM up and start over?

MR. CHEN: There is more add-on to CIM. Let me point out that, when CIM was originally introduced, it was intended for only the grid operation. However, today there is a package, a part of CIM that is designated for the market operation. There is a financial model in CIM.

The model is not functioning at this point because there are so many different markets there that it's difficult to have a standard at this point. But the CIM is a good avenue in the sense that it encompasses both the grid operation side and the financial part of it.

The issue again is, how do you first synchronize the market model, and from the market model you translate it into a mathematical model. Once that is achieved, to put that into a CIM or standardize it is a very simple procedure. The difficult part is up front.

MR. O'NEILL: I found that there is nothing better at disciplining a process than essentially making sure that all the definitions that go into the software design are consistent. When you have to actually write the software, the definitions become very precise, rather than

sometimes the stuff we see in tariffs here at FERC.

MS. FERNANDEZ: I was wondering if we could focus on sort of in terms of what FERC should be doing in the process. I'm hoping we truly don't have to get into defining CIM, since I admit that there are an awful lot of terms that I've never heard before.

COMMISSIONER BROWNELL: There's a reason for that.

(Laughter.)

MS. FERNANDEZ: In embarking on trying to do a role for standard market design, we've heard a number of stories from the past of embarking on market designs where they cost an awful lot of money and took an awful lot of time to get done. We sort of have an opportunity in the rulemaking to try and learn from the past experience and to try and set it up to make it easier to develop the software, which should then translate into a more cost-efficient software package for the buyers.

What I would like to focus on is sort of, what should the Commission's role be in this? Is it encouraging the development of standards-setting organizations? Is it mandating certain items or certain amounts of standardization, both in the market design -- is there anything the Commission needs to standardize in terms of the software? And I can see we've got two people.

MR. OTT: I think we'd at least be standardizing the market rules, if you will, as the initiative that's going forward. It's certainly going to help the software. Obviously, if you have a standard set of market rules, you're going to have a standard set of software solutions, so I think that's going to help a lot.

The one other area of standardization I know from my perspective as I work with my brethren ISOs, RTOs, whatever they are -- I'll be working myself towards this -- is the standardization of data interfaces. We have something we call a data dictionary, which I guess is a standard term for all of the generation demand, offers, et cetera, that come into our markets. Obviously, we're going to be working with the MISO and others, and ISO New England, to standardize that set of data. Once that set of data is standardized, you can work on standard Internet interfaces, that kind of thing.

But I think some help in that area might be another area.

MR. O'NEILL: Would it slow down or help the process if we tried to get a national group to do this, as opposed to Andy working with MISO and Gordon working with the New York ISO, and California working with RTO West or whatever?

MR. VAN WELIE: Let me try and address that.

I think the speed of standardization is directly correlated to the sense of urgency and the amount of money the customer is about to put on the table. And the customer could be, to some extent, the Commission; and of course then, the other customers being the ISOs and RTOs.

There are three ways in which to create a standard here. The first is the Microsoft way, which is one vendor gets so big that they pretty much create the standard, which I think is unlikely in this industry. The second is the normal standards creation process, which occurs they say within the IEEE or the IEC. That's a lengthy and time-consuming process, because what you have is customers dreaming about a what-if somewhere out in the future, and you have vendors jockeying for position based on how this is going to affect the next release of their product. So that's why it's slow.

I think what we need to do is create a customer who's got some money to get something done, and then you'll get something done. Even then, it's not going to be an instantaneous event. It's going to take some time, because of the pressures that I described in the earlier process.

So I think it's clear that there are some things which are a good starting point. CIM is a starting point. It doesn't cover the market side, but you can even look at taking what you've got already that's been fairly well

proven and extending it, which would be my proposal here.

And in terms of the application and integration bus, there's a lot of thinking that's already been done. The challenge is to find somebody who's going to carry the flag forward on this, and then to find a way that they actually have the wherewithal to get it done. Then I suspect the vendors will follow, because typically what happens is -- normally what will happen is a customer will put in a specification that, we would like to see the following features. And it's only when I put my vendor hat back on again, it's only when you see enough of that stuff appearing in enough specifications that you're responding to that you actually seriously start putting anything in your product design.

So from the day that you've actually created the standard, there's going to be a lag to when that standard appears, because of the software development process. So the sense of urgency that I tried to portray in my closing remarks in my presentation is that you need to create that customer. Therefore, there needs to be somebody that actually drives that forward.

I proposed EPRI as a possibility, because this happens to be the way they make some of their livelihood. That or some other organization could do this, and then they convene a lot of the bright people sitting around this

table, a lot of the vendors to my right here who really know how to go and make this stuff happen. And what you do there is, you have to put a neutral referee in the midst of them to actually get something done, which is a balanced solution in the end.

COMMISSIONER BROWNELL: Before you speak -- so, Gordon, I think what you're suggesting is perhaps that our role is to anoint some group to do this, perhaps provide the referee, figure out perhaps how to pay for it. Although I would think for all of you, even who are relatively mature, and certainly for your siblings who are emerging in other parts of the country, there are enormous cost savings to be found if we do this sooner rather than later, if I look at some of the costs that you have already incurred.

MR. VAN WELIE: Absolutely. The ISOs and the RTOs, to some degree or another, already support EPRI, for example. So there is probably a small funding stream going in that direction already.

The other thing I suggest, though, is apart from anointing someone, there are certain things that already exist today. The Commission could say, We want CIM to be the standard. We want CIM to be a standard that is used. I think that gives a big push to the industry to finally bring it to the position where something that works and is widely used -- Andy mentioned where Version 10 is just starting to

become usable. It took us a decade to get to that point.

I think there are certain technologies one can anoint at this moment as a starting point. Then we have to recognize that there will be other things that just haven't even been invented yet. That's where you put some of these bright people together with that gentleman over there and you say, you know, get started. We'd like to see something happen 12 months from now, 24 months from now.

MR. IRISARRI: Perhaps it pays to make a little bit of a distinction here between standards and requirements definitions. The standard has to be agreed upon. That's the definition of a standard. You have to get all the possible vendors, for example, to agree that they can deliver something on the standard. It's a long process. It may take many months.

Case in point, e-tagging. We're moving into 1.7 within the next few months. That is a standard. It was developed by Mirant in cooperation with vendors and the industry at large, and it has taken many years to evolve to the point at which it is now, and it's open for all the vendors to implement.

The other example is the IDC, on which we also have experience. That was a requirements definition. It was created by a small group within NERC and the industry, but it was sponsored by NERC. That was written and in

complete detail on all points from software development to the implementation of the testing, and given to a vendor. And the vendor implements according to that requirements definition.

The time frames for the development of these two artifacts or products are quite different. And of course the objective at the end is the same: build a good software system that complies with those requirements and delivers on the promise.

MR. SOBAJIC: Just a comment on the IT process. Gordon well described it, you know. One part of that is, when we realize that we need something, we have to realize that there is a process to get to that something. If we are talking about whether it's called CIM or not, this is irrelevant.

I think CIM, as we heard -- and this is quite correct -- covers the operations part, you know. Now we are saying, let's cover other parts. CIM may be just a name that holds the whole thing, you know, but it's called CIM -- M for markets or whatever.

We are now seeing, for example, CIM for planning. So there is a substantial CIM working toward that, but that process is very important, because that process involves exactly people that you see here sitting on the right of me, from my side, and their colleagues. This is where all the

wisdom comes from. This is the way how these things get done, you know.

There is a process of converging those technical opinions, if you like, and how these things could eventually fit into each other, until we all agree and have a consensus there. And it's a slow process, but it can happen, and it does happen and it did happen in the cases that we heard before. And of course it's a function of the funding that goes in there, you know.

You know very well that EPRI is an organization that is funded by -- it's a voluntary membership type of thing. Although most entities today would like to see something done immediately that will benefit them tomorrow, I think we still have a number of those that are having a vision that certain things will be good for the country, and they too fund CIM developments. They know it's not only going to benefit them alone, and only them, but it's going to benefit everybody. But still they say, go ahead, do it, you know.

So it's doable. It can be done. And again, you know, the process takes time. How soon? The sooner we start, the sooner we can have it.

MR. CHEN: Regarding standards, I don't think FERC should get involved. I think EPRI is the natural organization. They have experience. They've done it

before, and they are continually doing those things.

However, there's a second issue. One is the standard, the other is the direction. FERC should provide the direction, and the FERC should be very firm and clear in what they want in terms of direction.

For example, you can dictate, I want open architecture. You can dictate, I want a common data model. You can dictate, I want common user interface. Now, EPRI, help me get this done. That is the FERC's responsibility.

MR. ALSAC: I think we should not overestimate what we are expecting from standardization. In the past, standardization worked as a reference and not as helping the software development as such. What happened, for instance, in the case of EMSes, CIM is a good operation description. But we are seeing with the modern EMSes new requirements which are always beyond CIM.

So these standards are almost, as mentioned before, indicate agreements between different groups. But there are always new things coming, and standards follow -- unfortunately, rather than they lead.

Another thing is, we have to really try to understand what we are expecting by standardization at this point. It is very difficult to standardize something which is a moving target. Where market definitions are not standardized, it is very difficult to standardize the data

required by these definitions.

As a simple example, we have AC models, DC models, and similar differences in approaches. It will be a bigger effort to standardize all these approaches where different markets exist.

MR. PALIZA: I would just raise the concern that, although I believe the right direction is standardizing software development, creating those general interfaces, that does have good direction, that does have a good longtime goal. My concern would be in the short-term type of implementations, you know.

I think some of the panelists have commented, you know, in regard to how slow the process is in creating standards, making sure that they work, and also making sure that, you know, there are some tests that will verify that different vendors can pass the interoperability test. So my concern would be, well, how long is this entire process going to take?

In fact, moving forward with standard market design implementation -- although I agree with the long-term goal, I think in parallel we need to find other ways, as maybe Andy noted; that we need to move forward with some implementation that eventually will evolve to comply with the standards that will be developed.

That's my comments.

MR. VAN WELIE: Coming back to what can the Commission do, I think you can help set the vision. There was a statement by one of the speakers down there -- you are in the unique position where you are setting the vision on the vision on the market design. Therefore, you can be equally in the position to set the vision as to where we should end up with respect to the software side of this picture, because the two are like this. You cannot get away from it.

I don't think it's the Commission's business to get into specifying the details of this. You can hand that over to someone. You can appoint somebody to do that. I think it's very important for you to set the vision.

MR. OTT: I think the idea of what are we standardizing and what's our goal of standardizing -- the Commission, I think, should be concerned with standardizing what the market-customer interfaces need to be. When you get down below that into the technical data protocols, then yes, I agree: that's some other entity.

But the idea of my customers, the MISO customers, the ISO New England customers -- what interface they see, and how they interact, we don't want an engineering body standardizing that. We want the people interacting with the customer standardizing that.

You all can put that burden on us, or say: it is

your responsibility as the RTOs or the ISOs of the world to make this happen. You I think can do that. You can say, this is my vision, or it's our vision. I want it to happen.

But once you get down into the technical, the last thing I think you need is to get into that. I think what you're looking at is, what area of the market that the market participants are seeing. That's really the cost savings to the participants.

In addition to the RTOs having software development, every new piece of software I develop -- all of my customers, large and small, have to react to. I think that's fundamental. That's a huge cost.

COMMISSIONER BROWNELL: Thank you. That's one of our concerns. But trust me; we're not going to get involved in those little nitty-gritties. I've done this enough at the bank to know that that's the last place you want us, or where we want to be.

I just want to go back to see if I can rephrase Gordon's comments to get us started, because the issue of course was software. You're always waiting for the standardization or some of the issues that all of you have identified.

But if we started with that vision that said, we would expect in any software development open architecture, modularity, some of the other characteristics that you

mentioned, that that would get us going in the right direction, as we were perhaps at the same time identifying someone to work on the standardization issue so we don't wait for this endless process. That has to get faster, I think. That would at least get us going at the same time we're doing market design that gets a little more specific in terms of what the standardization categories are going to be.

Can we do that iteratively, at least not to wait any longer, or what?

MR. VAN WELIE: Yes, I think you can.

I think it's important we do the market design standardization. You can mandate, you know, the buzz words, I guess -- modularity and all those things. The problem is they don't buy you much unless you get a bit more specific than that.

The way you get a bit more specific is to say, there are certain things out there that we ought to just use, like CIM for example. Most of the vendors support CIM. I think if you went and did a sample across all the markets and all the utilities in the U.S., there are very few places where CIM is actually operational.

I think by just anointing that as a standard for now, that immediately gets surge in terms of moving things forward. Then there will be those standards that are yet to

be created. Those are the things that are going to take the longest time. That's where you set up the right people to go and define what those things are.

Andy said there will be those standards that are related to the external look and feel, the way people interact with the markets. And then there are going to be those standards related when you get inside the ISOs and the RTOs. How do you make these various applications communicate with each other?

And then, of course, what I was referring to previously, in terms of getting EPRI and some of the vendors together. They can figure this one out. The problem is, we need to have customer involvement, like ISO and RTO involvement, in that process as well. And I think you can really act to trigger that. You can give it a real push.

COMMISSIONER BROWNELL: I am reminded of David's comment, for which I wanted to thank you, that we need to look at this from the customer's viewpoint, because they're footing the bill. And the ramifications -- as, Andy, you pointed out -- of one change that you make has a ripple effect I think is something that we don't consider as often as we should.

CHAIRMAN WOOD: What level of vision, catalyst, kick in the pants, do we need to put in the NOPR after we discussed the things we talked about with the other five

panels this week? What do we need to put into that section that's titled, Software User Interface -- whatever you want to call it -- that is specific enough to give this some focus?

Do we need to anoint you, NAESB, or some third party to be the neutral? Do we need to do that in a rule or some sort of proceeding here? Say we want the three things that this gentleman said: open access, common data model, common user interface? Is that too general to state as the goal for this to actually get somewhere in a lifetime?

MR. VAN WELIE: What I tried to do actually is set out some of that within the presentation that I put together.

CHAIRMAN WOOD: You look good on TV, by the way.

MR. VAN WELIE: Thank you. That knocked me sideways.

(Laughter.)

CHAIRMAN WOOD: Back to software.

(Laughter.)

MR. VAN WELIE: The point I was making earlier on -- EPRI is a good choice. I'm not saying the only choice or the best choice, but they can get the ball moving in certain areas, rather than go off and create another body to go look at some of these standards in terms of the way these building blocks work together with each other. There's

already something that's working there. There's history behind it. The vendors work with them, and so forth.

The more tricky one is going to be the area that Andy referred to, which is in terms of the interaction of the marketplace, because I don't think EPRI necessarily has got all the content, all the people who have load, in that environment. That's something that probably ought to be done between the ISOs, RTOs, and market participants. We lack something at the moment and probably something needs to be created.

Would you agree, Andy?

MR. OTT: Yes. I think the push that you need to focus on -- obviously you're considering a standard set of market rules or market design standards if you will. I think along with that you need to consider a set of standard interfaces that RTOs have with customers. I think that kind of push would be the best. Essentially, you're looking for the biggest gain for probably the smallest amount of rule, and I think that the issue there is, in addition to a set of market rule standards, I think you need to at least advocate or strongly request a set of data interface standards with participants.

As far as interface standards below that level, I think you stay out. Probably the vendors at EPRI and others will find ingenious ways to do that, because that would be

the efficiency of building these systems.

I think the front end of it, though, with your customers, is the push I think you need to make.

MR. O'NEILL: Trip said something that stuck with me: that is, the shadow settlement systems. The market participants now are very interested in understanding how the ISO-RTO software works. How do we essentially create shadow software settlement systems and things like that that aren't terribly expensive, thinking for smaller users that they could get access to the data so they could simulate and convince themselves that this thing is working well?

The one thing you need here is the confidence of the market participants, and I was wondering how we could achieve that. What's the best way to do that?

MR. SUN: I'd like to respond to that in maybe two areas. First of all is data availability. That's the general topic, and as a specific example, in certain other markets, notably in Australia, the blackout period is 24 hours. After 24 hours, everything the RTO does is public domain. It's in a warehouse. It's on an IPO server. You can grab whatever you want with it.

That's one extreme case, one direction. The other one is perceived transparency, and I use the word perceived consciously. There needs to be transparency; no question. But they also must have perceived transparency in

SMD markets.

The essence of SMD today, I think, paves the ground for transparency, as was perceived transparency. By that, what I meant is ultimately, every market translates to a set and explicit mathematical equation or software codes. Different people read text differently, interpret differently. One of the reasons we're able to meet the four-month New Zealand model -- co-nodal pricing with authorization and all that good stuff -- is the precision with which the market rules were stated. They were stated in sufficiently clear and consistent rules.

If you look at the reasons why we are sometimes overly challenged in implementing RTO projects, it is because we read Section 6.8.9 differently. The participants read it one way, the rulemakers read it another way, and we read it differently. And six months later when we implement it, we find out, oh, that's different.

You need to generate transparency, consistency and logic. That's fundamental to the success of any market, and EPRI would do a great job pushing us in that direction. It's not going to solve all the problems, but with the data and with transparency, these things are indeed doable.

MR. OTT: I think data availability -- most of our participants, the ones of sufficient size, and to be honest even the medium-sized ones: actually, we calculate

the bill we send them every month. We put detailed billing reports on the systems, and they download them. They'll recalculate their bid, and they'll call if it's 20 cents different. And that's good, because they're actually verifying. They have the equations the same as we do. They write a little Excel spread sheet or whatever they use to do it.

But the point is, the data is available to them.

And I think on the front end of it, when I send my power flow model out to them, we put data out after six months. But the availability of data is also an issue.

I've always struggled with, should I ask the RTO to be responsible to supply some kind of software module to each of my participants to allow them to somehow interpret my results better? We struggle with that. Should we go to that expense and provide it as a service to the customer?

What we decided, based on talking to the customers, is: what they want is a high degree of data availability. They want us to put the data in a format that they can use, sort of a consistency across. Like if I call something over here orange, I don't call it green on this side. Then they have to translate it.

So I think data availability is probably the biggest issue for them. Again, you have the real small ones that aren't, but generally speaking, their participation

would be limited enough that they can do it just with spread sheets.

MR. DOGGETT: I was going to say essentially the same thing. I don't think you have to do much to facilitate the development of the software to do the calculations. The key is to insist that the data is there. They'll figure out how to use it.

MR. O'NEILL: If you have the data, let's say the bid data and the basic system configuration, could for example any of our four developers over here take that and essentially run their software and come to you and say, gee, my software solves faster, better, cheaper, whatever the criterion was, in such a way that they could independently develop software and move the process forward?

If we have enough information, can that be done also?

MR. CHEN: It can be done. But let me first come back to comment on the issue of the shadowing system.

Everyone mentioned that it is a data availability issue. I view it a little bit differently. It's not the availability of the data. You can see that 24 hours later, even 12 hours later, all the data are available.

The problem is, if you go into the data base, it's a huge amount of data. The true problem is, how do you package the data and model the data? So it comes back to a

data modeling issue. How do you communicate with the market participant to say, here is the data and it's consistent.

The way I present the data to you is consistent, and everybody understood that. That is the situation.

MR. ALSAC: I think to answer your question, it is possible for software vendors like ourselves, or for new ones, if this data is available, to help.

There are two sides to the software issue. One is really the software ISOs, RTOs use where there is full information, and everything is centralized. All the information is local, and how to solve at this address what ISOs and RTOs are doing.

The other side is market participants. This may be similar but very different functionality where not all the data is available, and they have to do simulations to figure out how they act in the market.

We are getting from like market participants so many requests, we have a web-based FTR functionality where small market participants can plug in their data and do FTR simulations in the PJM market to see how, at least help them how to bid and make their bidding decisions. This is very critical, and this cannot be done without data.

We are lucky that in that application, PJM is publishing all the necessary data, so such a service can be offered. But the people we are talking to require much

more, other functionality, which requires much more data. They want to do congestion analysis, predictions for the future, and in order to bid for an FTR they have to understand the congestion in their system.

These data are, unfortunately, not yet available, and as David says, if you can help mandate that such data can or should be available within reasonable times, much sooner than six months, then using this data we can help both market participants to respond and also to develop better, faster software and algorithms.

MR. IRISARRI: At the risk of beating a dead horse here, I would like to point to examples. One of them is certainly sponsored by FERC directly. It's OASIS, where the data is available, and there are very well-defined interfaces where market participants can access the data and download it using the Internet directly from the program.

The other example -- and this is a successful example as well -- is the data produced by the Interchange Distribution Calculator. It's available for most of the data, not all of the data, but at least the so-called participation factors are available to all market participants at the NERC sites, public NERC sites, where they can download it.

The issue with these data is the packaging. As mentioned earlier, you have to define the format of the data

in a clear manner, perhaps going back to standards. X Amount, for example, is currently a standard used in the computer industry at large to package the information. There are a number of packages that can be used very easily and use it in the application programs, be it congestion management analysis or settlement systems.

So it has been shown in the past that it's possible, and it can be used by anybody without a great investment in software. There is no need for an RTO to distribute software packages for their market participants to use the data and benefit from that.

Having the data available is a critical thing. For example, bid data is not available to everybody. Bid data is only available, at the moment at least, in MISO for example, to the owners of the data. The market bids are not available -- sorry, the system dispatch bids are not available to everyone. Public data, market bids, they might be available.

Outage data is a critical piece of information that has to be used to do any sort of analysis into the future. If you don't have that kind of information, it's impossible to do an accurate simulation of the power system and be able to reach reasonable conclusions on pricing and other important information.

MS. FERNANDEZ: I said before I was going to try

and take a break. This looks like it might be a convenient breaking spot. Could we take a ten-minute break and start up at 3:30?

(Recess.)

MS. FERNANDEZ: Will people get back to their seats so we can get started?

We have everyone back. Fernanda had a question, I believe.

MS. YOUNG: I had a question about benchmarks.

Do we believe for testing software we have information to build benchmarks, and how often do we update these benchmarks to take into account new information on what's coming in markets and so forth?

MR. OTT: When you say, benchmark, do you mean benchmark results or benchmark execution times?

MS. YOUNG: Benchmarks to validate the models and other software?

MR. OTT: We have a quality assurance plan that's part of our audit requirements. We actually validate the locational price solution once per month. In other words, they randomly select a five-minute interval, and that entire interval needs to be calculated using separate software. They have to match. It's required they match, and that's done essentially by our auditors once a month for the real-time software.

For the day-ahead software, it's done on a quarterly basis, if that's what you mean, so they are updated. The FTR software that we really don't have the time frame for, that's more or less ad hoc. We don't have a specific time frame that we do benchmark evaluations.

MS. YOUNG: Again, some of the data are used across the board. In the sense that it becomes a benchmark, a new piece of software is developed to insure the model and the software that you have physically provided is going to work.

MR. OTT: Right. In other words, we use three other software -- it's like my production software engine program, pricing, might be done by vendor A. I'm not going to advertise anybody today, I guess. Maybe I should.

Vendor A writes the production module. Then I have another module that can calculate the same thing, given inputs. That's how when we put changes in, that's one way we validate.

So when we put a brand-new piece of software in, it's supposed to do the same thing, but maybe has an enhancement of some sort. Then we just validate against the other module. Obviously, if it's something brand new that we don't have, then we would have to develop another module. And generally we do that. We'd go buy another engine or something like that. That's generally how we've done it.

Another way to audit it is to do like structured testing, if you will, where you say, I'm going to conceive a test, and here's what the results should be, test it, and see if it gives you that result. So it's very structured. There's very narrow data. The data is very well described.

What we found is, doing the alternate one is better, because the scope of the testing is much wider, and these are all structured tests.

MS. YOUNG: Should benchmark be added to the data standard?

MR. OTT: I guess I'll keep going. I think in our case that's part of the audit standard, so I think, you know, having auditability should be a standard. How you do it is probably between the RTO and the auditor, but obviously I think you must have audit standards.

In our case, at least, we feel -- and I assume most would -- if money is changing hands on this, it has to be an auditable process. And I think probably how it gets audited is probably below the radar screen of FERC.

MR. O'NEILL: When you say audited, do you mean like an accountant or an accounting firm?

(Laughter.)

MR. OTT: Not generally. Generally the auditor that comes to do this is generally not an accountant. It's usually an engineer. If your question -- obviously, it's

PriceWaterhouseCoopers in our case, but they have people other than just accountants. They bring in optimization people and test it. Obviously, they need our help to run it, but they sit beside us and we have one hand tied behind our backs.

MR. IRISARRI: If by benchmark you mean a point of comparison, that does not exist today for the sites that we're talking about here today, the future RTOs. Secondly, PJM, they may have quite a few checks and balances, but reference points and software that does the same thing independently developed to check the other results, I believe that there is no such thing.

In the systems with which we have had experience, say MISO is a new RTO. Right now the model that we are working with there has 25,000 buses and about 30,000 branches and so on. That size does not permit an easy parallel development of a benchmark to compare and to determine the accuracy of the original one.

In the future, as the systems mature, and more and more groups get involved, of course it will be possible to develop benchmarks and other independent tools to corroborate the results or to dispute the results. But there is no such thing to the best of my knowledge in this very large RTO system.

MR. VAN WELIE: I think the whole topic of

benchmarking and auditing is pretty broad. I agree with Andy: at this point in time, one of the things that the Commission can require is regular auditing, or if you want to call it benchmarking, of the software to make sure it calculates according to whatever rules exist within that RTO, that's probably state of the art today.

If you go back to the discussions I was having, or the presentation I made earlier on in the area of data interchange between various applications, that's something that once the standard exists there, a neutral body could be validating that these things indeed talk to each other. You can put the API stamp of approval on the product and say, these things actually do communicate.

The really complex one is whether you can actually get to a single, nationwide market design and set of rules to the level of detail that you can actually fashion these other data. And that's going to be a big challenge. I'm going to be interested to see just how far the Commission takes the standardization theme down into the details. Obviously, the more detailed the Commission gets, the better I think from the perspective of standardization. But of course there are all kinds of arguments why maybe that's not such a good idea. I've been watching those in the last few months.

From a standardization point of view, you need to

be very specific to be able to do the kind of benchmarking that perhaps you had in mind.

MS. FERNANDEZ: Why don't we just go down the line? I see a number of cards that are up.

MR. CHEN: I believe as a part of the standard that you should have a benchmark as part of that. Today we cannot run benchmarks because each one has a different design. So you have to benchmark individually.

One thing I wanted to point out that Gordon didn't touch upon yet: the benchmark actually is a legal issue. The issue is, when you put a software system out, the first thing the market participants ask you is, how do I know it has produced the right result, and who would guarantee me it would produce the right result? So the benchmark will have to address this not from a technical point of view, but also from the legal and liability point of view.

MR. ALSAC: I think if you are referring to benchmarking as testing the validity of results and checking the overall software, that is a valid point. But as was mentioned before, there are no references yet, and with such big, complex systems it is also tremendously difficult to compare software. This was attempted in the past on different, even much simpler software.

Like even today, existing power flows cannot be

compared because of all the standard power flows give different results, anyway. Because in their algorithms, their assumptions, the techniques used and the complexity of this whole problem is such that in the past, no one was able to compare and come up with something as simple as power flow benchmark.

But there are things like -- any power flow should give similar results under the same assumptions.

That is all right. But it is very difficult to compare things in terms of, for instance, performance, timing and other things that can very quickly become an impossible issue.

MR. SOBAJIC: I think Ongun has touched upon a theme that I was going to say. At least our experience has been, it basically boils down to the customer that you are working with, you know. Most of the developments that we have done are done usually with a utility or a number of utilities that are interested in a certain project. It ultimately comes down to them to sort of confirm that the numbers are coming the way they are expecting them, you know.

Of course, it's easy if you do something -- you're just replacing a block with another one that is maybe just faster. You can come to a reasonable comparison. But in many new developments, it's very hard to overcome.

That's what Ongun was saying. We have seen that.

But this is a very, very valid area to look into, because if you would go to the computer scientists, of course, these guys will tell you you change one line, you have to retest everything. And that's a very tall order, you know, when you start thinking about how many times the software maintenance happens and the changes are introduced in there, who is going back to check that everything that the software does has been reproduced or is reproducible?

I don't think that we are yet there. But that's a topic worth considering.

MR. DOGGETT: Following on that comment, I was going to say that we're working to develop some conditions, scripts, scenarios we can use for the purpose of what I call regression testing. So if we change column A and B, we want to go back and run this set of scripts to make sure that we didn't break columns D and E. That's something that we're working on so we can automate that process and then go from end to end, from the bidding to deployment and settlement, and check certain points along the stage and verify that we get the same results that we did from our earlier production system.

MR. SUN: On benchmarking, testing, how we define benchmarking: among the projects we have enjoyed the most success is the project where there's serious benchmarking

done by other than PJM. Sometimes we find a customer may not be ready to do the kind of -- due to whatever reasons, they often engage a third party, certification agencies. These again, it's not the RTO itself, it's not the vendor itself. It's a third party who certifies. It's a very, very serious process.

In that process, they approve not only -- their primary audience are the market participants, so they can stand up and tell the participants this software did indeed do what it's supposed to do. And they run very, very serious scenario tests: in fact, extreme case testing. It's not getting one set of data that can match two solutions. You hit the case so hard to find out what happens if there's shortfall, what happens if you have extra generation. You look at all those conditions.

That's how you wring out all the bugs you normally don't see, to prove something can work. You want to prove the thing cannot fail. That's a different mindset in testing, and it is tiresome, but it has tremendous benefits. We've seen that in a number of projects.

MR. O'NEILL: Let me pose the following question.

Suppose we issued a rule. We said that standard market design includes flow gates, transmission rights, point-to-point options, full demand-side bidding, and minimum bid prices for transmission. What would you need

for us to tell you additionally in order to make sure that we could actually get that implemented in a standard way across all markets?

That is to say, is it clear that when we say, flow gate options, you know what we mean?

MR. SUN: I'll take the first one.

I think those four things -- you should be asking, not are they implemented identically, but do they achieve the same market performance? So you leave the innovation to the vendors. That's comment number one.

Comment number two --

MR. O'NEILL: That's an interesting question, because if they were implemented differently, you're going to get different results from the same bids in different markets.

MR. SUN: To me, the proof of the pudding has to be for a given set of bids, the rule has intended for particular results to come out. And it's that results how we should check. Whether we use iteratively, not iteratively, DC, AC vendors, I mean, it doesn't matter. As far as the participant sees, they want to see a black box. Does this thing work? And we have to make sure the black box indeed works, not as a black box. So the black box should be seen as a black box to some people, but as absolutely transparent box, glass box to other individuals, and that depends on who the persons are.

So I take a strong position stating leave innovation in its place. Don't deprive us of the way to do innovative work.

MR. O'NEILL: No, no. I wasn't proposing to do that. I'm saying do you know what -- in other words, do we all have a common understanding of those terms that I just mentioned?

MR. SUN: I would certainly say no, at least not with the flowgates. There are too many assumptions in there today still.

MR. O'NEILL: Do we have any problems getting the demand side into the market? We were told earlier this week that we couldn't get it in because there were software limitations in New York.

MR. OTT: From my perspective, demand side is not a problem. It's really just another price quantity pair. It just happens to be the opposite direction.

MR. O'NEILL: But your market design allows demand-side bidding. And we were told that in New York, the software didn't allow --

MR. OTT: It's not the software, it's the data model. The data model in New York just doesn't go down to the nodal level. It's up on the zonal level. Essentially, especially their real-time system doesn't go down to that level of granularity. So I don't believe it's an algorithmic -- boy, that's a big word.

(Laughter.)

MR. OTT: It's not that problem. The problem is the data model. The data model doesn't get down to the sufficient level of granularity.

MR. O'NEILL: So what do you think it would --

MR. OTT: Well, you would say, you would obviously --

MS. FERNANDEZ: Or what should the Commission say if the Commission wanted to give lots of opportunity for demand-side?

MR. OTT: I think what you need to specify is that the model must go down to the nodal level. And then essentially a standard would be that you have a nodal

pricing system and you aggregate out to zones, and producing the answer as only the aggregated zone, but not producing the underlying individual prices is unacceptable. That facilitates the demand side.

To be honest, I think what I've heard from the New York folks, they're involved in infrastructure upgrade that will get them to that point, so I don't think it was for lack of desire. And again, I don't want to speak for them. But I think it was more to get it in place, to get their market up and running with the existing infrastructure.

MR. O'NEILL: So it was just a day two issue, it wasn't that it was designed that way?

MR. OTT: Based on my conversation with them, I think that's the answer.

MR. CHEN: I can assure you it's not a software issue. It's the similar software. Those kind of demand management, all those things, has been implemented in different markets with varying success. Now what happened is, for different market structures, you have those different functionalities. Now some market structures are structured in such a way that it's not easy to fit in some of those components which are successful in other markets.

So when you look at a market change of features, you have to look at the whole package. It's not just taking

one package from one market and putting it into that market.

That is different. I think that is what the gentleman is saying.

MR. O'NEILL: So if we were to say we want full demand-side participation, that could be accommodated without a lot of work?

MR. CHEN: When you say you want a full demand side accommodation and all the other standard market designs and say this is our vision, this is the whole package, and I want you to implement the market in this way, from the software point of view, we will solve the problem.

Now, again, I want to reiterate the point that David made. We have to be careful in terms of what kind of level we go to in defining the standard. We want to define the standard in such a way that you'll benefit from competition, benefit from modularity. However, if you allow that standard to go further down, you would actually kill competition because everything is so rigid. It's defined. There's no point for competition any more. People cannot innovate. So that is the point which we have to watch.

MR. O'NEILL: By the way, there's a difference between mandating a certain calculation method and understanding how that calculation method works. Because I have been told on several occasions that the way they calculate certain market software prohibits certain types of

transmission products.

And then I ask how, why, and everybody shuts up.

Because it's now proprietary software. But the proprietary software becomes an impact on our ability to do market design.

MR. CHEN: Certainly if FERC comes up with a very clear direction to say here is market design and here is even on the software from the architectural point of view, one thing I can assure you is that the software company will rise to the challenge, that's for sure.

MR. O'NEILL: Thank you.

MR. OTT: Could I jump in? When you're talking about the demand side and you go down, again, we're differentiating between an EMS and market system -- down in an EMS. If something, a generator looks different than a load does because in an EMS system, generators historically in the past could put off for data and be flexible and dispatchable and load really never really could in an EMS. And if you implement your real time market down in the EMS level without a market overlay, you could have something that's perceived to be a software problem, but it really is a modeling problem.

If you went in and pretended, tried to trick your EMS and told it, yes, that's really a generator, but I'm going to make it negative, it would work. And in our case,

what we did was just overlaid a market system on top, so the EMS doesn't care. Like I told you, our EMS is happily going along doing its reliability stuff and it doesn't care what that lunatic market stuff does.

But the point is, in the markets world and in the optimization world, the demand side is not hard. It's very simple. These guys will tell you. They've done it. I just buy the stuff. But the point is, is this. I don't think it's a structural software issue. I think it's a modeling issue in New York, certainly.

MR. IRISARRI: I would like to provide you with a benchmark so to speak. We have studied in detail the MISO standard market model. Let me call it that way for lack of a better direction at this point, which includes financial point-to-point. It includes flowgate rights, financial flowgate rights, and of course it has the size of a super RTO.

As Roberto mentioned earlier, they are looking for 30,000 or so nodes. We call them buses. Thirty thousand buses, 50,000 branches, say 1,000 or so flowgates. We have developed ourselves the software that addresses the need for an auction, say a yearly auction for such a system, that can auction off the FTRs on both the flowgates and the point-to-point.

We have tested the system with 14,000 bids of

which 10,000 are obligations and 4,000 are options. We have the mechanism to deal with the options in that auction, and it of course satisfies the system's visibility tests, that is constraints on branches and flowgates.

One proviso that I'd like to mention that agrees with the comments made earlier by Andy as well is that this system has been designed to deal with the so-called DC or linear. The reason for that, there are many reasons, but one important reason perhaps is that the timeframes in which you do this auction tends to exclude the voltage concerns. Voltage concerns are more closer to the real time operation of the system. That's a benchmark for you to consider. It's visible, it works and it can be done very quickly.

It very quickly can be interpreted in many, many ways, depending on the concerns. But we can execute this program and compute all the options and store them in a database in a matter of five to ten minutes. We will have the opportunity of showing the software in the future to anyone who's interested.

MR. ALSAC: My comment is on a slightly higher level, although we have similar software to address. All the MISO specifications. What I would like to refer to again is my opening remarks. There is a loose coordination between market designers and software vendors. And this was the case in all the RTOs which we have worked with,

including California, there were always things first specified and then checked if it is really feasible to do these things.

And it may be, to answer your question, that FERC can also, before mandating certain things, can check. I'm sure software vendors will be glad at least to respond whether for instance what you specify demand side, that together with all these things can be done. At least it is possible to find some of these things' feasibility before mandating any of these requirements.

MR. VAN WELIE: I'm going to try and answer Dick's question in a different way. And just to leverage what the previous speaker said, is the market design has to allow for, the basic market design, the rules said, have to allow for the demand response. That's the first problem.

And if it wasn't designed that way to begin with, then you've got a problem in terms of having to go back and reengineer that.

The second problem, and I'll ask you to turn to page 7 of the handout I gave you, I said that's a very simplified view of the software architecture. What that architecture really shows on page 7 is a decoupling of many of the applications, and the decoupling is achieved through standardizing the interfaces between these applications -- the CIM and the extension of the CIM and this application

bus.

So what you then do is you isolate the problem.

If you're going to go in and introduce new functionality, at least you're limiting it to one of those little squares, and you don't have the ripple effect that you're going to go back and dig the roots out in four other applications or four other systems.

And I think that's part of the problem that we've seen occurring historically. In New York, for example, the one thing I'm aware of is that they've got a very old EMS system, so their applications, these blocks up on the top, are very tightly integrated into the EMS system. I think as they go forward and try to solve their underlying architecture, it will become easier for them to solve these problems.

That's why architecture here in terms of the systems that get implemented as well as the standards that are introduced are so crucial to allowing speedy response to market rule changes. It's when they're all tied together like spaghetti that you really make it hard to move swiftly.

COMMISSIONER BROWNELL: This is a little deviation from the script, but just so that we can bring to closure the question, Dick, that you raised about DSM. This is addressed to Gordon and Andy. Anyone else can chime in. If I heard most all of the panel members correctly today, in

fact there is software to support the introduction of a demand-side management program today.

So what is lacking perhaps is the political will of the market participants. Where are we missing the boat here? A hundred percent of the RTO commentators in the last month have said we think demand-side management is important, but it's not there, not really.

MR. OTT: I think from the point of view of the software being able to accept demand-side bids, in other words, for instance, in our day ahead market, we have virtual demand bids which are essentially, if it were happening in real time, it would be the same thing. So the software itself, the market software, can price and use demand-side response. Once you get down into the real time systems, of course, we have plenty of virtual bidding, demand bidding, price responsive bidding in our day ahead market. There's lots of it happens every day, thousands of megawatts.

But those are hedging instruments. They use them to hedge. In real time, the demand response is not there primarily because of the communications infrastructure meters back to that demand. The ability to see real time pricing real time and all of those infrastructure issues, I think that's where the lack of ability is. It's not in the computer programs, it's in the expense of putting the meter

there and getting the telecommunications to each of those facilities.

Structurally, that's one. Then of course there are jurisdictional issues of who should pay for the meters and there's other things like that.

COMMISSIONER BROWNELL: Andy, wouldn't it be fair to say that at least one of your member state commissions has been working very hard in the last year to have more comprehensive demand-side management program introduced in PJM and has been unable to accomplish it because of kind of some market segment has not embraced it with the enthusiasm that we have seen here.

MR. OTT: Right. There are certainly issues related to various constituencies in the market, yes, absolutely. But it's not a software issue certainly. I think that was your original question.

COMMISSIONER BROWNELL: That was the question. A leading one at that, but a question.

MR. VAN WELIE: I was just going to support that. I don't see it as being a software issue. If your market design, which in the PJM case, supports the ability to do this at a wholesale level, you're okay.

The other issue which I wanted to reinforce was the infrastructure issue. You've got to have a situation where the retail load has the ability to be able to see the

price signal, do something about it. And you've also got to have the control room be able to see it in return. Because if they can't see it, then they can't count on it in the long term. So that's the wholesale problem.

The big issue I see, though, is that there's this glass ceiling in place at the moment at retail level. So there's a lot of work that's got to be done, because the retail customers through standard offers and these sorts of mechanisms are really shielded. And so you have this intermediary who may not be financially incented to even do anything about it. And to really make it work in the long run, we're going to have to solve that piece of the puzzle. I don't think technology is the constraint here.

MR. PALIZA: I'm just going back to some of the comments that the vendors have made. I'm actually glad that some of the vendors are looking at the MISO model and the standard market design and are actually trying to see how feasible it is to solve that large network model.

I believe that that is important in order to make sure that, you know, we have a workable approach to implement the markets in the Midwest. And in that regard, I just wanted to touch a little bit on the flowgates modeling.

I think a lot of the confusion stems from the term "flowgates" that seem to be used in a different way in different parts of the country.

However, in the Midwest we have been using them for a long time for operational purposes. And as Guillermo mentioned, the IDC has been implemented and used in the day-to-day operation of the systems when overloads are present. So we might have to do, just go one level down in the Midwest and define them a little bit more clearly in order to be able to specify this to the vendors.

On another topic but related, because someone brought it up, as a customer, the Midwest RTO is very much interested in fostering competition among the vendors. That's the best way to drive the prices down and really set the market for these. What the Commission is doing by proposing this standard market design and development goes a long way in that direction.

I think we may have to go several levels down so that the vendors have clear requirements to work with, and, you know, they can develop these modules that they can basically be plugged and played. Because that's what we want as the customers. We don't want to be hooked to a single vendor. We want to have the choice. And whoever produces the best should be the one that is given that piece of the project.

And the third topic that just came up, and I wanted to bring forth a statement I made in my opening remarks is that we should not let limitations in the tools

drive policy. We should have as a goal that the tools are built in order to implement policies.

MR. LUONG: I had a question about the performance, about the software performance. And since PJM 25,000 buses made an output every five minutes and come out and calculate the LMP and then MISOs only have 30,000 buses, how long will it take? Is MISO going to come up with 15 minute or 10 minutes until you come up with the LMP price? Maybe 15 or 10 minutes?

MR. PALIZA: That's exactly the challenge here is in, you know, what kind of software or hardware architecture is needed in order to process these large networks. Obviously, you use a particular architecture. You know, like PJM is using in order to process 3,000 or 5,000 buses. When you are talking about 30,000 buses, we may have to use probably processing or distributed processing in order to be able to crunch that amount of data in a reasonable timeframe.

Also, we need to start thinking about well beyond just hardware and software solution, but, you know, how are we going to manage such a large operation in the Midwest? Do we need now a master control center and then satellites? That discussion has started in internally in the Midwest ISO. We are proactive in that regard and have started looking at different alternatives on what would be the best

configuration in order to make sure that we can maintain availability of the system and respond in a respond in a reasonable timeframe to customers and to system conditions.

MR. OTT: I'll just throw in a comment. I think obviously we're looking at larger models, larger network models and how the software perform on them and looking at parallel processing, especially parallel processing of the security analysis. We feel that the state estimation itself is really not going to be limiting as much as the AC security analysis, which is the thing that takes the longest time, and you need in a near-term model.

So we're looking at parallel processing and some other things. But I think the real limitation and part of the challenge that you're going to have in the MISO is the number of control areas you have underneath the market and the amount of data flow, telecommunications and data flow that you need between the control areas. I think that's probably their biggest challenge as they move forward.

But as far as the software being able to perform, to do the near-term power flows, I guess I have faith in these guys over here that they'll figure out a way to do it.

MR. CHEN: I agree it's a challenge. But the true challenge is to make sure you gather the data right for this 30,000 bus model. From performance, from software point of view, it can be resolved. ABB recently ran the

entire market application with a 40,000 bus and we're very comfortable about our performance.

Another thing I want to mention is that I really liked the diagram Gordon put on page 7, the sort of architecture. Here he discussed the issue of software components. You have modularization of the software. But this architecture has another advantage which is not just having mentioned that, but another advantage of that is scalability. And that would resolve all those software issues or performance issues you have. And this is the type of architecture we should start moving towards.

Now I'm not going to tell you ABB has exactly the same architecture for our software.

(Laughter.)

MR. IRISARRI: There are two challenges in developing applications to meet the requirements that we will see in the future, 30,000 buses. One of course is the implementation on the algorithms or the programs. You can do a lot with today's hardware without the need for parallel processing or actually multiprocessing or distribution of software. Actually, that makes software very complicated and much harder to benchmark, a lot harder to check, much more difficult to audit.

Now of course we have all tracked the history of parallel processing since the early '60s. And parallel

engineering has been a topic in almost every IEEE presentation for the past 35 years. And I don't think there is a single implementation -- as a matter of fact, the parallel processor companies are out of business. You'll hear -- where is Cray now? Cray is nowhere to be found. Control Data Corporation used to have its own parallel processors. Syncing Machines Corporation in Boston is out.

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However, the current hardware available from stock vendors, let me call it that way, Sun Microsystems, Compaq, Hewlett-Packard, et cetera, each of those computers has eight processors, eight very powerful processors that you can use with very careful implementation to achieve the type of performance needed to address the very large systems.

I'd like to mention the IDC. Once again, the type of calculation that goes on in the IDC is very closely related to the type of calculation that is going to take place in say security-constrained dispatch. You still have to compute the so-called generation shift factors, load shift factors to address the demand side, and you have to do it for many, many thousands of buses. You have to do it for many thousands of branches. And we can do that today very efficiently.

So it's a dual challenge of incorporating the

proper equipment, hardware, with the proper algorithms. And the hardest part, in my opinion, after years and years of working with these programs, is developing the right algorithms that are efficient, can scale up. There is a significant difference, order of magnitude difference from 2,500 buses to 35,000 buses. It's a tremendous difference that is not easy to address just by throwing in more hardware to the problem.

MR. ALSAC: I fully agree with Guillermo, but I have another comment. I think as the system sizes grow, not the algorithms, not the performance, not the speed, but gathering this data, gathering it correctly. Because even with much smaller implementations, there are very few utility state estimators are running correctly. And the reason is there is not enough data, not enough redundancy, not consistent data. And if you increase the size of the systems from 3,000 to 30,000, the problems of handling data becomes a tremendous issue rather than the algorithms.

I think we really have to address gathering all this data at the same time without time skews and putting it consistently in the database and into the application software. And handling those errors during the gathering of this data correctly is a much, much bigger challenge to check it, to find inconsistencies in this data, is a much bigger challenge than the algorithms, once the data is

there, solving them.

I believe like the other software vendors, the size of 30,000 bus is not a big challenge. And if the software is developed correctly, if it is scalable, then this can be done. The only issue, just for instance with New York demand-side problem was that they were claiming, in order to model demand side -- this is only a software issue I want to say -- in order to implement demand site, the sizes, because they have to now go into much lower levels to model these demand-side requirements, the loads themselves, which they are not currently modeling in their EMS applications, they were saying that New York size will go from 3,000 to 15,000. And 15,000 is not that big a thing, but if their software is not scalable, then of course this can create a software challenge.

But any good design software can handle demand-side issues without any problems. I think the implementation issues are other things than the software.

MR. CHEN: Actually I want to comment on that. The 40,000 bus testing was actually used in New York system, in New York software package.

MR. SOBAJIC: Just a comment. In terms of the size and how to handle that, I think this data issue is really a considerable problem. EPRI has been working on the study called the reliability initiative in the last two

years, and that involved the analysis of the Eastern Interconnection.

So the size of the system alone was I think going up to 90,000 nodes or buses. And I think the system was able to handle up to 40,000 contingencies -- that means outages. But the key problem was to get consistent data across the Eastern Interconnection. NERC has certain systems that take into account like generator outages, and they are kept under the same rules, what they mean, what is the outage? Somebody has to specify, when to record it, when not. However, for the transforms for the lines, this goes all over the place. And as we were going and working with all security coordinators and with the entire Eastern Interconnection, that was a real challenge. I mean, running a program, of course, it is a problem. But I would say nothing in the magnitude of getting the data.

And as you know, as people say, garbage in, garbage out. You can eventually have the parallel processing and everything else and run it, but it's worthless, you know. That's something that perhaps you guys can think about. You know, how to unify this, I don't know if the word "standard" is applicable there, but unify the way how to gather the data to mean the same thing.

CHAIRMAN WOOD: There's something we haven't talked a lot about, and that's security of the systems,

cyber security. And I'm trying to remember in ERCOT. Is that all hard wired back and forth, or is there still some Internet usage that people can use to do their scheduling and settlements?

MR. DOGGETT: They still use Internet to do some scheduling.

CHAIRMAN WOOD: What's the plan for MISO, Roberto?

MR. PALIZA: We also have Internet access. We use encryption in order to make it a little more secure. But definitely, that's an issue.

CHAIRMAN WOOD: What level of encryption would you all be at? 128 or?

MR. PALIZA: I'm not sure.

CHAIRMAN WOOD: Andy, what are you all doing in PJM?

MR. OTT: For market systems, we have the Internet. We also are working on dedicated private networks for our customers. They foot the expense and we --

CHAIRMAN WOOD: Right.

MR. OTT: The other, for reliability stuff, of course, that's all dedicated feeds from the generators themselves.

CHAIRMAN WOOD: And those really don't overlap? What kind of security issues should we be aware of as we

kind of start to talk about standard market design and trying to make these very user friendly for wholesale customers and the like? Where's the friction place between a very secure system that's impermeable to, you know, cyber nuts and something that works very well for allowing a lot of people to be participants in the system?

MR. OTT: Again, I think using the Internet to get the scheduling data in is really just a way to get in. I think on our side we have to make sure that we have bulletproof systems, isolation from the Internet. Our EMS can't touch the Internet, for instance, and things like that. So I think on our end, we just isolate the reliability systems from the external effect so if there would be something in there, it would only take out that part of the system.

I think the concern on our side as well as yours, you know, obviously back-up control centers with redundant communications. If you come around PJM, we have a lot of construction going on right now to deal with those issues. And in general, I think the RTOs are probably all in the same boat. The heightened awareness has caused us all to do that. I'm not sure that would be a requirement for you to mandate that, simply because I think our own members would mandate that for you, if that's your question. I think in general we have --

CHAIRMAN WOOD: I just want to actually understand better. I don't know if any of them are mandated.

MR. OTT: In our case, we've put a lot more emphasis on obviously the physical security and the back-up center. We don't really have a back-up market center, and we have a project responding to create one. We have two different projects that are in front of our members now. Actually the members just approved the cold back-up side, "cold" meaning a warm one will get up within 24 hours. A cold one may take a couple of weeks.

The point is, we're looking at doing that obviously in our interaction with other RTOs, we could use each other as back-ups, too, and I think that's something else we'll look at.

CHAIRMAN WOOD: Guillermo?

MR. IRISARRI: Thank you. Of course, security is a very complex and extensive topic, and it is very hard to address it very quickly. There are many issues related with that. In the first place, there are two independent sources of insecurities. One would be, say, a rogue hacker getting into a system. Let's put that aside for the time being. Let's talk about the market participants. You still want to make sure that every market participant is certified to access the system. So certification is a big important topic that has to be considered.

The California ISO just recently issued a request for proposal for a new auction system and in that request for proposals, one of the most significant topics is certification of market participants, and the vendors have to provide the appropriate tools with encryption of 128 bits or even higher.

The second thing that is important is validation of the customers, validation of the market participants, credit validation. Should they be dealing in the systems? It's a very, very significant issue, and we have very recent examples that attest to that.

Then comes the issue of communication systems. Do you have, for example, do you use the Internet or do you have independent communication systems to provide the data?

Many of the large utilities out there, for example, utilize their own independent frame relay systems to enter day into IDC or for tagging purposes. Tagging is supposed to be through the Internet because it's totally open, but you still have to allow for the possibility of for reliability reasons and security reasons, many companies utilize their own frame relay systems, and we have to incorporate those.

Of course, you have to provide the standard protections which are the so-called firewalls that almost any computer system has, firewalls and routers that are able to filter out, for example, undesirables' IP addresses. For every customer that is valid, that is certifiable, you will know from where their messages are coming. If you find an IP address coming from somewhere that you cannot recognize, you simply do not allow data to come in from that, and so on and so forth.

So it's a big topic, very important, and it should be addressed properly.

MR. CHEN: I think security as an issue has to be addressed seriously. One observation. ABB has done a lot of market systems around the world. It's interesting to note that very often the highest security requirement is not always in U.S. It's at those projects outside. And they have much higher requirement on the security, for whatever reason.

And again, the security issue are two issues.

One is access to the system, which has been mentioned. The second issue which we also have to make sure is addressed is we have a way to identify who you say you are. If you say I'm X, Y, Z, what is a way to prove that? And when you submit a bid, how can I associate the bid with this particular person and make sure that it's a positive match? And there are standard softwares, and there are standard infrastructure there.

So from technology, point of view, there are means to achieve security. It is the willingness or the demand from FERC. Probably you should address this to say here. This is what we think the level of security, which is a requirement. Otherwise, the incentive from RTO point of view, from customer point of view may not be that strong. Because security is like insurance. And you cannot see direct benefit when you spend the money.

CHAIRMAN WOOD: What would you propose, then, that we say in that regard?

MR. CHEN: I would first do a survey of the general security requirements around the world on similar systems and then to make a judgment if the level of security we today are doing is that adequate enough? Is there any risk? And from there, make a judgment.

MR. SUN: In addition to the access security

issues, I would just like to bring up from a broader prospective security, data availability is also important. And data availability today for the larger RTOs, quite often we depend on data being transmitted to the RTO from subordinate transmission operators or their lower subregional EMSes.

The notion of data have been routed through existing legacy systems presents a threat. So having a more available direct data access at the source of the data through substations so they become a data server servicing not just necessarily the existing transmission operators but also RTOs or other retail access providers is the direction I think we should be looking at.

The other topic is the notion of redundancy in control centers. We classically have been looking at a hot or cold standby or primary dual backup. But it's also possible to operate in the cold primary mode. I've seen some sites in NEMCO in Australia where the two control centers, one in Brisbane, one in Sydney, a thousand kilometers apart, at any instant in time, both control centers are controlling part of the system. So the notion of having constantly operates on alert and properly trained provides a level of security that's also useful to us, and the technology exists today to do that.

MS. FERNANDEZ: Why don't we turn to a few

questions from the audience?

MR. SINGH: Yes. Hari Singh from PG&E National Energy Group. One particular area of SMD that interests me is the day ahead market, and in particular the use of security constrained unit commitment let's say using Lagrangian relaxation, as Dick alluded to in his opening remarks.

It's very interesting that if you go to a super RTO and increase their size of the problem, many of those concerns associated with nonconvexities tend to go away. So you get solutions that are more reliable. But at the same time it becomes more difficult to find the solution in a reasonable amount of time. So I would like to hear from the experts on the panel, the vendors, if they believe that such a solution is feasible for a system of 30 to 50 thousand nodes, as would be the case in the MISO or the MISO and SPP. And if not, then the choices are basically to have perhaps a different design for the day ahead market or to say that RTOs cannot be more than a certain size. Thank you.

MR. IRISARRI: Certainly the unit commitment is one of the most complicated problems that is faced by the vendors and the utilities because of its solution. Yet it's one of the most critical ones, because is the so-called resource scheduling system for thermal systems. I'm not even going to address here the even more complicated one,

which is the hydrothermal scheduling.

But anyway, looking at a system the size of the Midwest ISO, once again, where you have 30,000 buses and 45,000 branches and you have maybe 2,000 to 3,000 generators, not all of those have to be considered in the commitment because many of those are precommitted. But the number of generators to consider in the commitment, if that were the case, would be staggering, would be too large. There is no expertise yet that shows how to solve the unit commitment problem on systems larger than 300 generators that is efficient and can solve the problem for the next day.

One of the largest systems is PJM.

MR. OTT: We have 600.

MR. IRISARRI: Well, even 600 generators, it's not even close to the 3,000 that will be needed at Midwest ISO.

Now the other issue is, do we really need to have the unit commitment as part of the standard market design? I believe -- this is my personal opinion here -- that the generator providers, they are the ones who do the commitment, and they bring their bids into the market and then the role of the RTO would be the dispatching through time for the next 24 hours, for example, of those units that have been previously committed by the market participants.

The so-called dynamic dispatch, which is this problem that I'm alluding to, that is a feasible problem. You can do a dynamic dispatch with network constraints that will respect branches and flowgates over a period of 24 hours and in addition, you can put constraints such as reserves, which this morning we heard how critical they may be, because you run out of reserves before you run out of capacity, you can put those constraints in the dynamic dispatch, and it will be able to solve. And it seems to me at least that that's a reasonable topic. Of course it's a topic of discussion. It will be nice to hear what the other panelists have to say.

MR. O'NEILL: Can I add something? The issue of the unit commitment in the day ahead market is simply not just an issue of calculating the optimal solution. The unit commitment over a market the size of the Midwest is probably not a huge consequence to the Midwest. But for the entity that didn't get committed when it should have been committed, it's a big deal.

And the other thing is, is that what we have seen is that if you don't give people the opportunity to bid their startup no load cost, they have to game the market, because they can't express their true cost in the market and they have to game it.

And then they have a ready made excuse when we go

to do market power mitigation that they had to do what they had to do, not because they were trying to exercise market power but because they were trying to fit themselves in. You know, they were a size 12 foot trying to get into a size 8 shoe. And they had to do some very extraordinary things to make that happen.

So that the issue is not whether or not the optimal solution of the entire Midwest is off by a half a percent, but it's one of the two primary drivers, in my opinion, of the RTO market design, and that is reliability at a reasonable cost, and the ability to mitigate market power without a whole lot of gnashing of teeth and strange explanations of why people did things that they did.

MR. SUN: I'd like to comment on Hari's question on the philosophy of who should make commitment decisions. I think this is one area where I think SMD as a platform must support full commitment. At the same time, it does not imply every participant must utilize this feature.

Then as far as running a unit commitment problem is concerned, I'm very concerned with what's going to happen in the West when we're dealing not really just with scheduling the units, but we're dealing with scheduling the field in the form of order, and that's a level of complexity we should be cognizant of.

And as far as running the unit commitment

problem, I think it is, one, automatically more difficult than the SCED. SCED with the dispatch problem, as Guillermo was saying, it's quite manageable. UC is complex, but what we have also seen in simulating in the PJM case expended Northeast case, the amount of self-committed units is large. And that reduces significantly the problems that we may see from classical unit commitment. Of course it introduces other complications. But overall, I feel that when we look at these large systems, it is not a number crunching capabilities, nor in fact the algorithmic limitations. It is the ability of the people to manage to put a good judgment on these artistic decisions. If you do not have a sense of the size of the region, the business process becomes more challenging than actually reading the numbers, finding the numbers out themselves.

So in the case of PJM, we find the ability for PJM operator to understand the system is quite manageable. Now I'm not sure in the case of expanded footprint of the RTO West from BC Hydro down to the middle or in the expanded Midwest ISO if similar expertise exists or similar business process exists.

MR. AMATI: Marty Amati, Niagara Mohawk. I should say as of a week ago, of the National Grid Company. We've heard a lot of talk about standards today. I just wanted to bring in the December 19th FERC order which calls

for the industry to develop an organization/process to be a single one-stop shop for developing the business practice standards.

And we've also talked a lot about standards today which I think cover the gamut of business practice standards, software design standards and perhaps data transfer standards that fall below the threshold of what would be considered market transfer information. So I guess I would like either the panel or the Commission representatives to perhaps comment on what is the understanding between what that March 15th filing has attempted to do versus what we're trying to do here in terms of defining standards for software implementation. Is there an overlap or are they separate or if they do overlap, how do they overlap?

MS. FERNANDEZ: I'm not sure we know the answer. I think it's probably something that in seeking to have a standard-setting organization that we got into a lot of discussion today, as you said, in terms of certain things as to what sort of the overall benefits of having a standardized market design and also if there are certain costs and implementation benefits to having standardization in the software or data models, whatever.

And as to what that has done with a standard-setting organization or done in a standard market design

rule where the Commission encourages standardization is probably still an open question.

MR. SHANKER: Roy Shanker. Hari is being polite, so I'll ask his question again, because it's very important and we didn't get an answer. You are going to make some important decisions soon about structure and sizing for RTOs with MISO and Alliance, Northeast, some sorts of consolidation.

A key element of a reasonable market design is going to be a two settlement system with a day ahead market. We're going to need that for both market power issues, as talked about, also to eliminate some gaming characteristics, and also to get a reasonable and consistent market for clearing and transmission rights across the entire area that we're dealing with. Those will come out of the first settlement.

If the vendors today are saying I can't talk about larger than 1,000 generators, we ought to hear it, because I don't think we want to sign up for a three-year investment process for the RTOs to be funding their development of new software. I thought that's the kind of thing that we were here to talk about today.

And I have to say to me, it's inconceivable that you guys have not benchmarked on larger systems and seen what you could do. You may for proprietary reasons not want

to answer this today. That's a separate question. But somebody here has to feed into the Commission the ability on what's the scale for a day ahead process? What's the size of a problem we can handle, and what can we do realistically? Because otherwise, we're spinning our wheels, because if we can't get an SCUC that works reasonably for a consistent, stable solution, then we ought to be rearranging the priorities that the Commission is seeing about standardizing a design and scale of the RTOs.

I mean, Hari's question is exactly on, and we need an answer. So if you don't want to answer here, that's fine. But the Commission needs to get this answer someplace right away.

MR. CHEN: I don't think that there is a short answer to your question. But at the same time, I'm not sure I understand your concern at this point. What I would suggest is I would contact you offline and we can discuss this further. I'd be very interested to discuss this.

CHAIRMAN WOOD: What he's saying, though, is we need to know. Standardizing -- I think, Roy, to answer your question, I think standardizing can happen with 15 RTOs. But the question then becomes if we're going to standardize down to a certain level and pass the baton off to maybe six or seven of you guys to then translate that into the detailed operating protocols and then use that to build

software to make that all happen, then is there a maximum size there?

I mean, you described some numbers with quite a few zeroes on them as far as how you're making the MISO software issues work. Does that presume a certain more simplified market structure than maybe one that Andy and them live with, or does that kind of say, yeah, we can go to locational marginal pricing with the day ahead market and yada, yada that we've talked about for the last six months, and we can do it from a software perspective across SPP, MISO, up to Manitoba over to maybe the Alliance companies?

MR. IRISARRI: There are a few assumptions. Indeed, everybody has to make assumptions at one point or another. I mentioned earlier that the models that we have developed and tested with very large scale problems assume the linear approximation, was a DC model for say the auction and even and the security constrained dispatch.

CHAIRMAN WOOD: What are the hazards of using -- of making such an assumption?

MR. IRISARRI: Earlier it was mentioned by Ongun and others that the AC models to even begin to solve for the large systems that we are required to implement here on the order of, say, 40,000 buses, is almost impossible.

Let me give you an example. The NERC IDC today uses a model that is created by a NERC committee, the Data

Model Working Group. That model has exactly 35,000 buses, 40-some thousand lines. That power flow is in most cases a nonconvergent power flow. Now the IDC does not need a converge solution to do its calculations, because it's again based on the linear model. So we only use the configuration of the Eastern Interconnection. But we don't have to use the voltage, which is the complex part of computing with these programs.

As a consequence, the decision is to approximate down to the so-called DC model. Now I can just define the DC model if needed. It's not the issue right now here.

CHAIRMAN WOOD: Just explain to me, what do you lose by going with the DC model versus the AC model?

MR. IRISARRI: There are a few things that you lose. First, you lose the impact of voltage, the so-called voltage reactive power. You lose that. You cannot simulate that with a DC model. And there's certain equipment you have to make approximations. For example, SVCs is voltage control devices, are very nonlinear. DC lines. You cannot model them in the same amount of detail that you would model them in the AC application. Phase shifters is the other one, the other device that you have to do certain approximations.

So you lose -- virtually every nonlinear piece of equipment, fax devices, is difficult to simulate. However,

I contend that for the types of problems that we are dealing with, the long-term problem, certainly most of that is not needed. Even the security constrained dispatch and real time security constrained dispatch may not need that. As a matter of fact, it is not necessary because of all the complexities that have been addressed here earlier today: Data volumes, data quality, modeling issues for that system sites.

So if we accept the premise that the DC or linear model is sufficient, then I agree that we can solve problems such as the security constrained dispatch and even the so-called dynamic security constrained dispatch over a period of 24 hours with all the network constraints, real power. And even some approximations for the voltage. It might be possible to do external iterations, assuming that you can get a good power --

CHAIRMAN WOOD: You can do that for how big an area?

MR. IRISARRI: I'm assuming that we will be doing that for a system of the size of the MISO, RTO, so 35,000 buses, covering essentially the geographical area that you described before.

CHAIRMAN WOOD: Andy?

MR. OTT: Just to put it into perspective, in PJM we use AC, the real detailed AC models in the real near term

for the reliability operations. That's like, you know, every minute, moving ahead every 15 minutes. So we look at the very detailed voltage device and everything else, the full AC model.

For all the market systems and for the security constrained economic dispatch in the near term, the five-minute pricing calculation, et cetera. All that is a linear model. It's all linearized. And in the forward auctions, the transmission rights auctions and all the markets. And essentially, we take all of the voltage constraints and put them into the linear model.

Again, a market system is really just making sure that you're physically feasible from a market perspective, you're financially adequate.

CHAIRMAN WOOD: What MISO's doing is proposing that that five-minute function be done at the umbrella level but that the control areas would do the four-second or whatever the intervals are. Now would they also, like what Andy's describing, on the very short term, do that?

MR. IRISARRI: Yes.

CHAIRMAN WOOD: An AC model for that control area?

MR. IRISARRI: Yes. The real time model which is the state estimator, it's a full-fledged state estimator with AC implications and all that. That provides the base

case data to do the market applications. That is, calculations, security constrained dispatch, LMP calculations, and LMP calculations in the short term. For those, LMP calculations, you use a linearized model.

MR. OTT: And it's sufficiently accurate to --

MR. IRISARRI: It is definitely accurate for that purpose. And the action, which is the other issue, it has to be revenue adequate, I agree. But for that, again, the DC model is plenty sufficient.

You can incorporate some approximate voltage restrictions, but then you have to make more approximations, and sooner or later, the series of approximations are not gaining you much, perhaps even hurting if you are not careful.

CHAIRMAN WOOD: Do the other vendors agree with what you just heard?

MR. CHEN: I agree with that in general. The performance of the software depends heavily on the assumptions you make. You can actually change the performance by fact of time. One example is AC and DC. We have to make sure that when we make assumptions, we know what the level of error we're dealing with. Most times -- and I'm speaking from experience of ten years in looking at the old EMS industry -- people tend to be very strict on the software accuracy. They neglect the data accuracy. If your

data is only 2 percent accurate or the accuracy is at the 2 percent level, you can make a lot of assumptions.

So to come back to the question, unless we know what kind of assumptions we can make, they obviously have a concern. It's difficult to precisely say what kind of performance we can deliver. However, in general, I would say that the software performance should not be a big concern in the overall market design. There are several factors. Number one, the computer power increases every year by a factor of -- there's a standard, Moore's Law, about this one.

So if we're designing a market model today and limit the market model because of computation power, three years later the problem is still going to be there. That's number one.

Number two, we really have to look at what kind of accuracy we need. We're not going to look for the perfect solution which produces no value. That would be my comments.

MR. SUN: Roy, before you answer your question, I will answer your question more explicitly. But before I answer that, I do want to confirm that we are in full agreement with the assessment of AC versus DC. In a nutshell, you don't lose a whole lot. You lose nothing by going to AC in a market. I'm not sticking my neck out

pretty far on that one and be very explicit. The tools we use are AC based tools. So in the future, as the market finds out that we need to go to AC, you go to AC. We're not developing AC-specific tools generally speaking. The AC tools from EMS are there. We chose not to use it because the loss is minimal. That's the simple part.

The hard part of Roy's question, how big is too big for unit commitment? I will point to that question. And I think the way to answer that question, at the size of the Northeast region, we're very comfortable.

CHAIRMAN WOOD: Define Northeast.

MR. SUN: The Northeast as in PJM to New England, that sector. So 1,000 generators. Quite comfortable with it.

CHAIRMAN WOOD: Comfortable with it that it is not a problem?

MR. SUN: It is doable.

CHAIRMAN WOOD: Due to the unit commitment issue or just --

MR. SUN: Right. Well, let's start with security constrained ED is no problem. Going to 50,000 buses. I mean, if you look at order of magnitude. Fifty thousand buses for security constrained ED and security analysis in general is not an issue, in terms of computation.

Unit commitment is more complicated, and I will not go into details at this point, but it's a more complex problem. But I think today what our experience is is up to a thousand generators. Let's just say a thousand generators.

But you really should ask the question: why do we run unit commitment? What is it that we need? And I think the thing we really need is, should we look at the notion of a pool settlement system? It brings forward to the participant a mechanism to hedge, as far as how much you get exposed to real time.

That's one purpose. The second purpose is, it brings into the market operator, the physical operator, a sense of have I got a capacity for tomorrow? If I don't have enough today, my generation mix is not right; I may be stuck. So we give the guy a day-ahead process to get that capacity in.

A pool commitment, a commitment by looking at the scheduled on-line capacity, provides a very good mechanism to get that capacity. But it's not necessarily the only way to insure that capacity that's available in the day-ahead market, in the day-ahead time frame.

So if I look at MISO's day 2 model design, as was in ERCOT's current operation today, there is a day-ahead activity. It is market-based. For that market mechanism we

secure additional capacity to assure the real time system is viable. That to me is fundamental. That we cannot give. There is no give on that.

MR. SHANKER: Just to follow up on that, the last part is indeed the question I want answered. Just to clarify: what you heard in pieces, the discussions on AC/DC issues were principally for real time. My personal feeling is I'm more towards comfortable with the DC characterization of certain things, so I'm fine with that.

Some of the other things you heard were auction-related things about the rights in the system. Those are less time-critical. Those can be a week. The one thing we are focusing on in the last answer is something where we have maybe a five to 12-hour window, which is how we commit the system a day ahead. For just the reasons you discussed, it's a critical market hedging and security instrument, and if a thousand is a limit -- and I want bigger; I think anybody who's heard me here in other contexts knows that I want as big a system as we can -- but if a thousand starts to be a limit, I'm not as hyped as Dick is on optimality. I'm more for stability.

If we can go larger and end -- he knows this, because he heard me yell at him once a week about this -- I can live with a suboptimal, day-ahead commitment as long as every time you run, we get the same result so people can

make proper investment decisions on replicable systems.

It's fine. But if you're starting to say a thousand or 1500, the Commission needs to be considering carefully how strongly you push SPP, MISO, Alliance to being in a single piece, because you may be setting up something where you're going to price them out of the ability to have important hedging and security tools.

That's why it's important. The decisions -- there are structural formations of the market decisions taking place now. It's not standardization. We know what a good standard design is. It's what are the coalitions, you know. Will SeaTrans and Great South join together? Will the Alliance become part of PJM? How far do you push those things?

If it's a thousand-generator limit, it has practical implications. If it's two or three thousand, it has probably not very many practical limitations, and we don't need to worry about it.

MR. SUN: I would like to clarify. I did not imply a thousand is a limit. What I'm saying is a thousand --

MR. SHANKER: -- which is what you're comfortable with.

MR. SUN: We should also look at all the market systems.

MR. SHANKER: What I'm saying is it would be nice for people to be experimenting bigger.

MS. FERNANDEZ: I guess when you're saying a thousand is your comfort zone, what kind of feeling do you get when someone says, two thousand is the scope of the proposed RTO? Is this something where we don't have experience but we have confidence we can do this, given technology? I'm not confident we can do it.

MR. SUN: I think we should look at actually going into the physics of the system. If I look at the northeast, traditionally it's a tight pool. A lot of commitment decisions used to be made by a PJM-like organization. If we're heading west a bit, it's not clear if we offer pool commitment as an option. That's a chance for the players to use. How many will use it?

So if two or three guys use it, everybody else is now scheduled. It's not an issue. But if everybody uses it, how should we guess?

That's why I think, just be aware in the unit commitment process there is a level of heuristics involved. We call it by fancier terms, but it's not as clear-cut as a linearized LP solution. We survived, we improved.

When we started first working with unit commitment as an industry, a unit's a good-sized utility. Then we said, well, what's 500? We took an order of

magnitude jump and we survived that jump. That didn't give us heartache, but we worried for a few months.

Now we said, we're going to do a thousand. We thought that was pretty hard. We worried for a few weeks, and it wasn't that bad.

MR. OTT: Just to clarify, the Northeast RTO simulations that we were doing, we got data from New York, New England. David was the vendor we were using to do the unit commitment analysis. So it's actually probably hedging more towards 1200 or 1300 actually, but whatever.

In the results we were seeing, when he says he's very comfortable, he means it solves in reasonable time to where we could still meet a four-hour requirement to clear the market with probably time to spare. So when he says he's comfortable -- since I'm your customer I can say this -- the point is we have experience that we can do a unit commitment across an area including about 1200 generators with ease, if you will. I use the word, with ease, in the sense of it can fall well within my time frame for clearing the market.

I think the reason we can't say, or at least we haven't tested 2000 or 2500, so I don't know the answer -- I can't say that I know it will be done in twice the time. So at this point, the best I can give you is, 1200 seems to work, and you know, I myself, if I have enough spare

research money, will continue. But at this point, I'll encourage these guys to try.

MR. SUN: We are continuing. The number of generators has much more profound impact than the number of buses. It's the number of units that matters.

MR. OTT: One other area we're looking at is a hierarchical structure. At PJM we feed up from -- you go to a single market. If you had some kind of limitation we could get into hierarchical commitment, where you do two and coordinate them. So I don't know that I would get too excited about reducing tail-end design because of software at this point.

CHAIRMAN WOOD: Glad we asked.

MR. IRISARRI: Unit commitment is a very complicated tool that can be used in many ways, and I don't know here when we say, unit commitment -- it's not clear to me exactly what they mean, to be frank. If the unit commitment is used as a hedging tool, and you include all the constraints that should be included in startup times, shutdown times, minimum up-and-down times, emissions constraints, different types of reserve constraints, fuel constraints, crew constraints, and a few others, then you will not be able to solve the very large problems with a thousand units or so with current technologies.

If on top of that, you add the network, and the

network is an all-encompassing network covering areas as described earlier, it is much more complicated. The security-constrained dispatch becomes a sub-problem of that very complex problem.

Now generation producers are not interested in network constraints. In reality, they can study them to hedge their bids and to be ready to deal with those. However, an ISO of the size of the Midwest ISO is very interested in making sure that all of those constraints are met, and that the units are dispatched, to say the least, satisfying those requirements, to be able to compute the adequate prices and give the right signals to the market.

So I don't know exactly what is meant here, because it's a very difficult problem. The unit commitment that I know is very difficult.

MR. OTT: The unit commitment we're referring to, just to complete the discussion, is the one with all the temporal constraints, where you have the min run times, the min down times, and all those constraints.

MR. O'NEILL: It doesn't include crew constraints.

(Laughter.)

MR. CHEN: It's in the format of up and down over a time period.

MR. OTT: Anyway, it does include that, and we

have touched on it.

MR. SUN: No fish constraints.

MR. O'NEILL: Unlike Roy, I am very confident that you folks and your compatriots can rise to the challenge.

MR. CHEN: I think what is important here is not just those constraints of down time and up time. The true constraint, as was mentioned earlier, is the network constraint. It's the security constraint.

You have to have a unit commitment that can resolve these not-valid network constraints, so the network does play a big part in the solution. And that is the biggest, most expensive part of the solution.

MR. O'NEILL: If things really get tough, we'll put Fernanda back in the game.

MS. FERNANDEZ: You're ruining my ability to end this by 5:00.

MR. SHANKER: One last question. This is again to go to what Dick said.

I think I can see doing what Andy said, a hierarchical approach, things like that. The problem I have -- I mean, I can come up with about half a dozen ways to solve it, but I have no idea how stable the solutions are. I have no idea how stable the marginal costs are, and I probably think I'd want to sit and talk with a group like

this about maybe redesigning the way we did the ICAP market if we were going to change this kind of commitment project.

Because suddenly, people's assurances, the variances that they face in revenues -- the whole risk structure starts to change a little bit. And you might want to do things differently.

So Hari's question was, if we have this kind of constraint, might we want to change the market design? I think the answer is, if we have large, day-ahead SCUCs that are stable, that look like we have now, we can do the northeast, et cetera -- I'm real happy with the market design we have for the standard market design. If we start going and weakening the ability for stable, predictable prices, maybe with large excursions on marginal prices for unstable commitments that are still reliable security-wise, we may want to rethink other parts of standard market design.

I'm not saying not to do it. I don't want you to do this and find out we have such unstable day-ahead markets in terms of replicability that we're putting people out of business that are risking hundreds of millions of dollars in capital investment.

MS. FERNANDEZ: I think I'm going to let him have the last word.

It's been a good panel. It's time to go. Thank

you all for participating today. Just a final reminder: if anyone heard something that they feel the need to comment, you can file comments in RM01-12.

Thank you.

(Whereupon, at 5:05 p.m., the meeting was adjourned.)